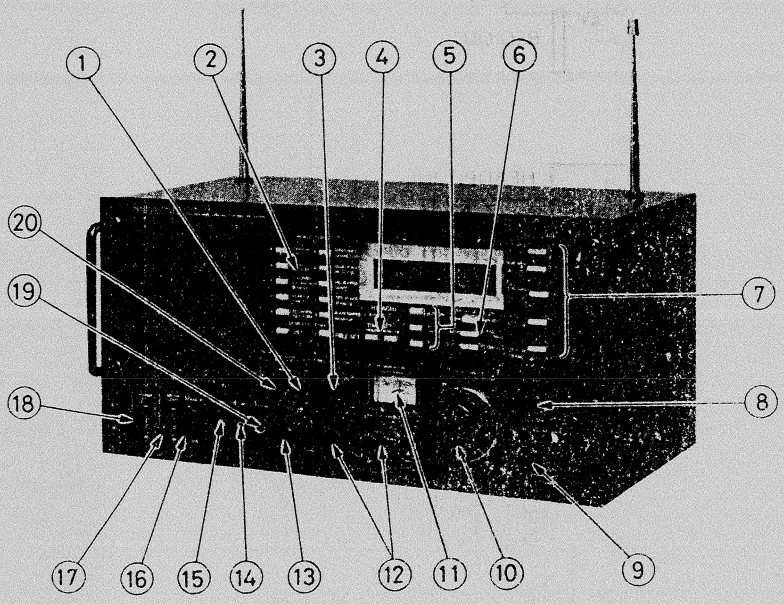
HITACHI

KH-3800W

SERVICE MANUAL

No. 1184



KEY TO ILLUSTRATIONS

1. BFO SWITCH
2. WORLD CLOCK BUTTON
3. PICH ADJUSTMENT CONTROL
4. TIME SET BUTTON
5. AUTO/SLEEP BUTTON
6. DISPLAY MODE SELECTOR SWITCH
7. BAND SELECTOR SWITCH
8. SW CAL BUTTON
9. SW/MW RF GAIN ADJUSTMENT CONTROL
10. TUNING CONTROL BUTTON
11. TUNING METER
12. TONE CONTROL
13. VOLUME CONTROL
14. EXT. SPEAKER JACK
15. RECORDING JACK
16. STAND BY SWITCH
17. METER ILLUMINATION SWITCH
18. POWER SUPPLY SWITCH
19. HEADPHONE SOCKET
20. FM AFC/BAND WIDTH SWITCH

CONTENTS

SAFETY PRECAUTION

The following precautions should be observed when servicing.

1. Since many parts in the unit have special safety-related characteristics, always use genuine Hitachi's replacement parts. Especially critical parts in the power circuit block should not be replaced with other makers. Critical parts are marked with ⚠ in the schematic diagram, and circuit board diagram.
2. Before returning a repaired unit to the customer, the service technician must thoroughly test the unit to ascertain that it is completely safe to operate without danger of electrical shock.

FM/SW/MW DIGITAL TUNING RECEIVER

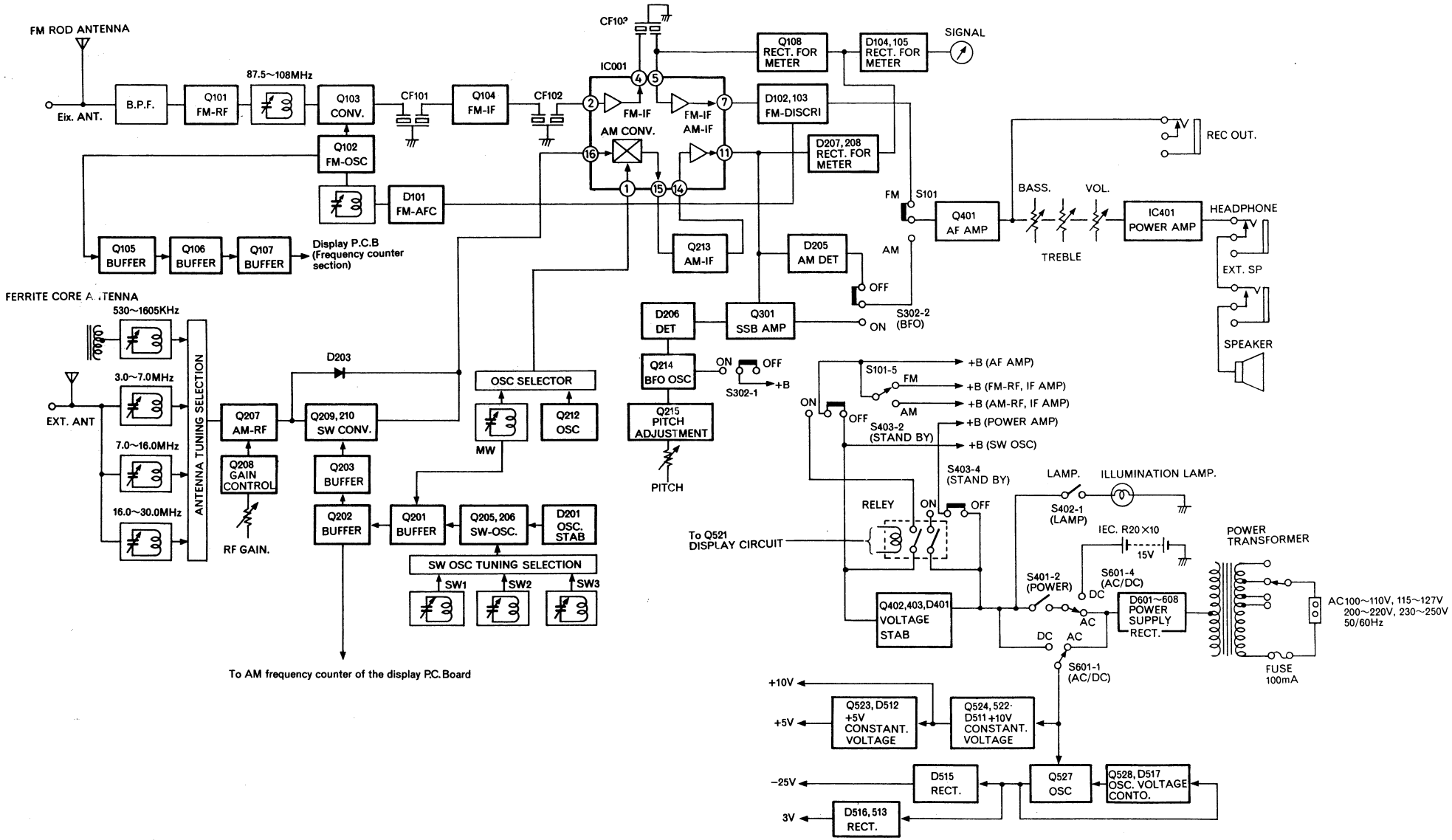
SPECIFICATIONS

Semi-conductors:	IC's (Including micro computer): 6 Transistors: 28 Diodes: 15 Varister: 2
Power (Mains) Supply:	AC 110 to 110V, 115 to 127V 200 to 220V,230 to 250V 50/60Hz DC 15V (IEC R20 x 10)
Display System:	Fluorescent Display Digital Display System
BRIGTE System:	Dinamic Bright System
Display Contents:	Tuning Range Display World Clock Auto/Sleep indicator Power failure indicator Reduced voltage indicator Auto time display
Error of Clock	15 second/
Speaker:	12 cm P.M. 8Ω
Power Output:	2W (T.H.D. 10%)
Power Consumption:	8W
Battery life:	20 hour
	External Speaker Terminal: 8Ω Headphone
Input and Output Terminal:	Recording Output Terminal
Weight:	8 kg

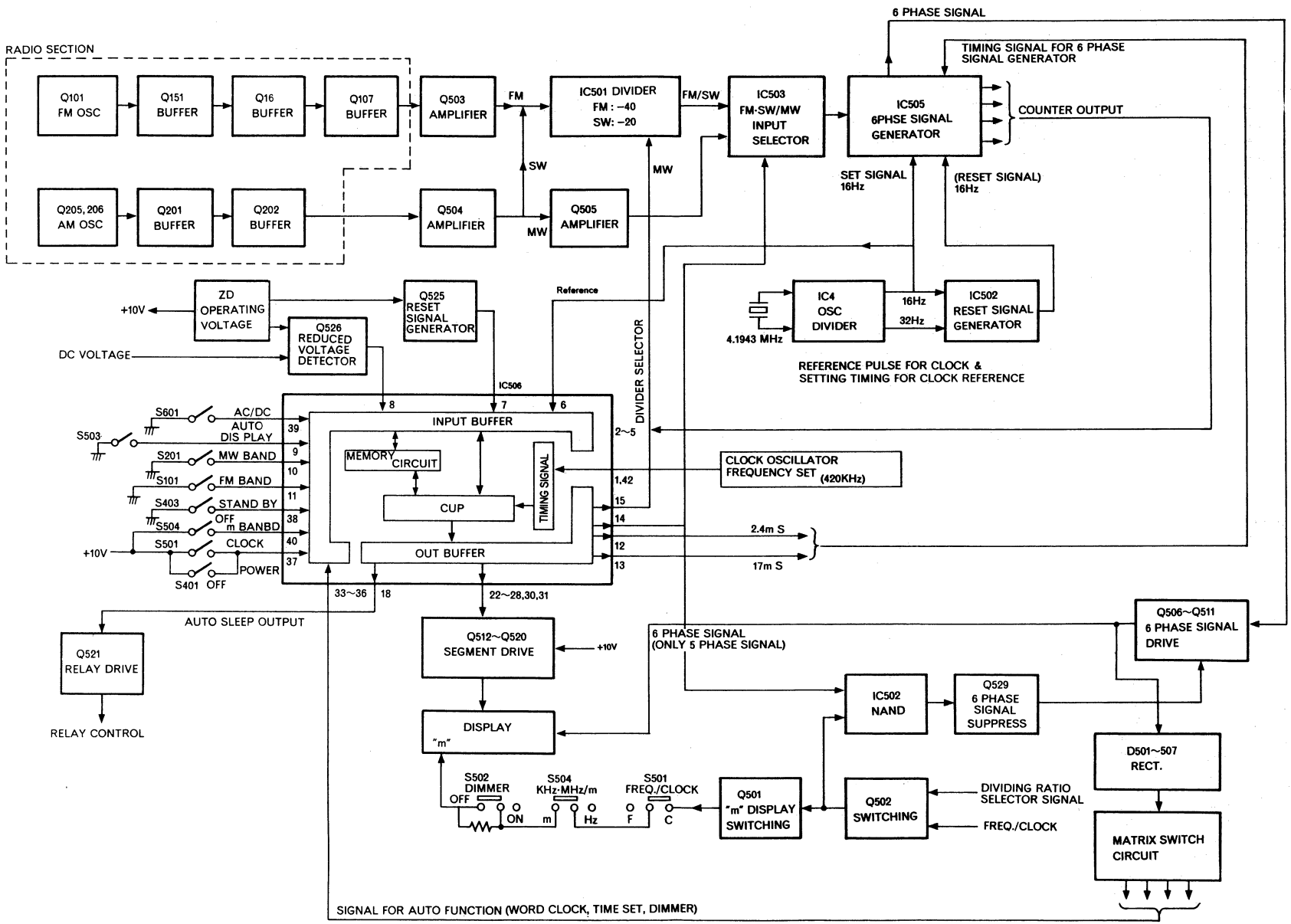
Dimensions:	240(H) x 440(W) x 300(D) mm
Circuit System:	FM/MW 2 band single super-heterodyne SW: Double Superheterodyne
Tuning Range:	FM: 87.5 to 108.0 MHz MW: 530 to 1,605 kHz SW_1: 3.0 to 7.0 MHz SW_2: 7.0 to 16.0 MHz SW_3: 16.0 to 30.0 MHz
Intermediate Frequency:	FM: 10.7 MHz MW: 455 kHz SW: 1st IF 2.0 MHz 2nd IF 455 kHz
Antennas (Aerials):	FM: FM Rod Antenna or External Antenna MW: Built-in ferrite core antenna (aerial) or External Antenna SW: SW Rod Antenna or External Antenna
Sensitivity:	FM: 10dB (pra.) 3dB (max.) MW: 44dB (pra.) 30dB (max.) SW_1: 14dB (pra.) 0dB (max.) SW_2: 17dB (pra.) 3dB (max.) SW_3: 20dB (pra.) 7 dB (max.)

BLOCK DIAGRAM

1. RADIO/AMPLIFIER/POWER SECTION



2. DISPLAY SECTION (Microcomputer circuit)



OUTLINE

KH-3800 is a highly sensitive 5 band (FM/MW/SW_1 - SW_3) radio which is able to receive SSB short wave radio communications, CW (telegram) and international broadcasts from countries all over the world as well as standard FM/AM broadcasts. It is highly sensitive; tone quality does not deteriorate as output level increases, short wave tuning is easy and reception is stable because of the double-superheterodyne system used. The best features of this unit are that the reception frequency and world clock are controlled by a microcomputer, the frequency counter displays the reception frequency in 0.1MHz units during FM reception, 0.001MHz units during SW reception and 1kHz units during MW reception, and by setting the timer of the digital world clock, the reception of any broadcast is possible by simply setting its time and frequency. Power is supplied only to the local SW oscillator circuit during waiting time, so the broadcast can be heard with stable reception starting at the set time. The tuning knob can be varied in 2 stages (FAST/SLOW) for easy tuning. This radio is the first in the world to display the meter band of SW broadcasts digitally. The next important feature is the 24-hr digital world clock for 11 places with an AUTO/SLEEP timer function. A 2-way AC/DC power supply is used; since the consumptions of the battery life is reduced when the DC power supply is used, an AUTO DISPLAY function which automatically cancels the DISPLAY indication is provided. External antenna terminals are provided as well as a built-in telescopic antenna exclusively for FM, a built-in telescopic antenna exclusively for SW and an MW ferrite antenna, so this unit is a total communication receiver.

SSB

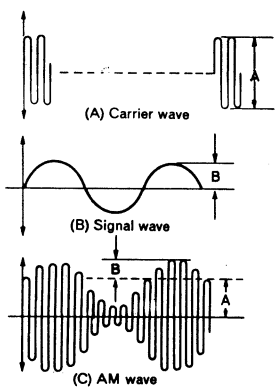


Fig. 1

When the carrier wave (A) as shown in Fig. 1 is amplitude-modulated by the signal wave (B), the AM wave (C), the amplitude of the carrier of which changes according to the amplitude of the signal wave is obtained. When the carrier wave fc (kHz) is amplitude-modulated by the single signal fs (kHz), the AM wave containes the frequency component - - fc — fs (kHz), fc (kHz), fc + fs (kHz) - - as shown in Fig. 2. The bandwidth [(fc + fs) — (fc — fs) = 2fs)] of this frequency is called the occupied frequency bandwidth, and the component (fc — fs) kHz is called the lower side-band, and the component (fc + fs) kHz, the upper side-band. Replacing fs by a voice signal, the waveform of the voice signal is very complicated containing various frequency components from 300 Hz to 3,000 Hz, so it results in an AM wave, with very many upper side-band and lower side-band waves between ± 3kHz of the carrier wave. The occupied frequency bandwidth is specified as 6kHz in Radio Law. The system to transmit both the upper side-band wave and lower side-band wave is called the double side wave band (DSB) system. The component of the signal is contained in both the upper side-band and lower side-band, so communication is possible by transmitting either the upper side-band or lower side-band. This transmission method is called the single side wave band (SSB) system; in amateur radio, this system is used by almost HF band voice transmitters.

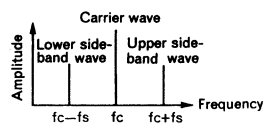


Fig. 2

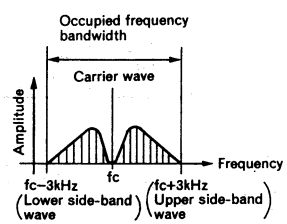


Fig. 3

The SSB communication system has the following advantages compared with the conventional DSB communication system.

1) Since only one side-band is used, the occupied frequency width is reduced to 1/2 and the number of possible channels is doubled.
2) Only the electric signal is transmitted because it does not contain the carrier wave, interference is reduced and beats do not occur.
3) Transmission power can be reduced because the side-band on only one side is used. Assuming output power equivalent that required by a 100% modulation DSB system, the SSB power requirement is 1/4, that is 6dB less.
4) S/N ratio is improved in reception side (Improved by 6dB in transmission power and 3dB in bandwidth for a total of 9dB).
5) It is only slightly affected by selectivity fading (because the bandwidth is halved).
6) In addition, multi-transmission is possible. It cannot be picked up by ordinary radio sets (using DSB reception), so this system gives greater privacy.

On the other hand, it has the following noise disadvantages.

1) When receiving broadcasts in the high areas, speech and noise may be received alternately because the noise suppression effect of the DSB system is not present.
2) The composition of the transmitter and receiver are complicated.

SSB demodulation

To demodulate the SSB wave (fc — fs or fc + fs), by generating and mixing the carrier wave (fc) in the receiver, the difference audio signal is demodulated. The carrier oscillator is called the carrier generator. When the demodulated audio signal does not best with the suppressed carrier frequency, the played-back sound tends to be high or low frequency. Therefore, the BFO (Beat Frequency Oscillator) control RV301 is provided in the receiver to vary the carrier frequency. When the BFO switch is OFF, the intermediate signal is detected by D205 as shown in Fig. 4 and is fed to the input of the audio frequency amplifier circuit via R246, S302. When the BFO switch is changed over to ON, power is applied to the carrier generator circuit and the SSB amplifier circuit, and the output of the SSB amplifier is connected to the input of the audio frequency amplifier circuit. Q214 is the carrier oscillator which varies the base bias of Q215 by means of the BFO control VR(RV301) to change the equivalent resistance between the emitter and collector of Q215. The equivalent capacitance of C260 is changed by changing this equivalent resistance which changes the oscillation frequency. The oscillation output of Q214 is mixed with the intermediate frequency signal via C261, D206, C255 and the audio frequency is demodulated simultaneously. In addition, it is input to the audio frequency amplifier circuit after being amplified by Q301 through filter C260. The same operation is performed during CW reception.

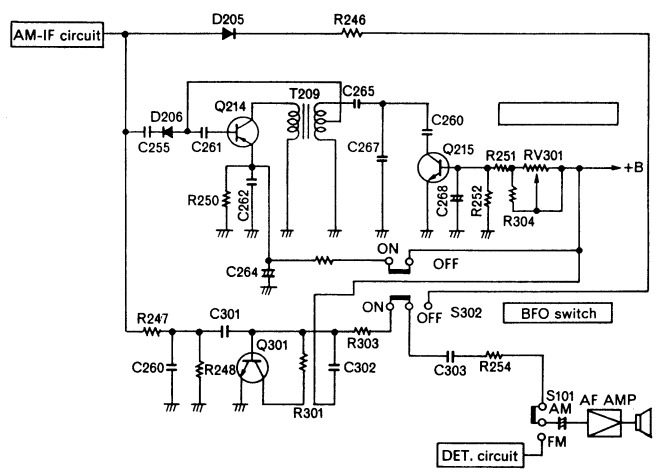


Fig. 4

CIRCUIT DESCRIPTION

Outline of the display circuit

The display is driven by a microcomputer; the contents of the display depend on the condition of each mode selector signal based on the frequency counter signal and the reference pulse signal. This circuit can roughly be divided into the input peripheral circuit and output peripheral circuit and the microcomputer. The input peripheral circuitry is composed of a reference signal oscillation circuit, mode selector switch circuit, initial reset circuit, reduced voltage detector circuit and matrix switch circuit. The output peripheral circuitry is composed of a segment drive circuit, 6-phase signal generator circuit and relay control circuit.

1. Reference signal oscillator circuit

The 4.1943MHz crystal oscillator circuit and the divider circuit are composed of the crystal and IC504. A stable 16Hz pulse is output from terminal (11) of IC504, and the 32Hz stable pulse is output from terminal (12) of IC504. This pulse is the reference of the operations. The 16Hz pulse is input to terminal (6) of the microcomputer and the frequency counter. This is the reference pulse for updating the time and synchronizes the microcomputer and the operations of the peripheral circuit simultaneously. The 32Hz pulse is input to the NAND gate of IC502 as shown in Fig. 6 as the gate signal and the 16Hz pulse to the other input terminal, then pulses as shown in Fig. 5(c) are output. This pulse is input to the frequency counter of IC505 and resets the internal counter by every 16Hz.

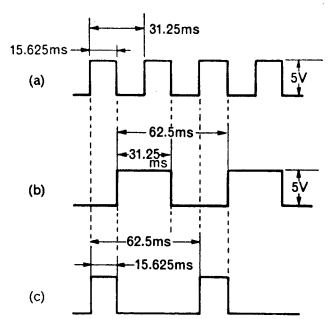


Fig. 5

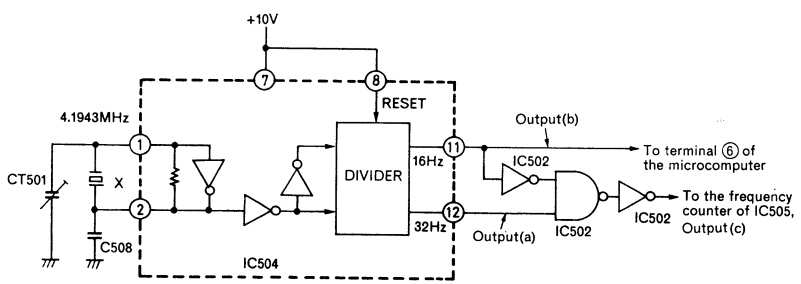


Fig. 6

2. Frequency counter, 6-phase signal generator circuit

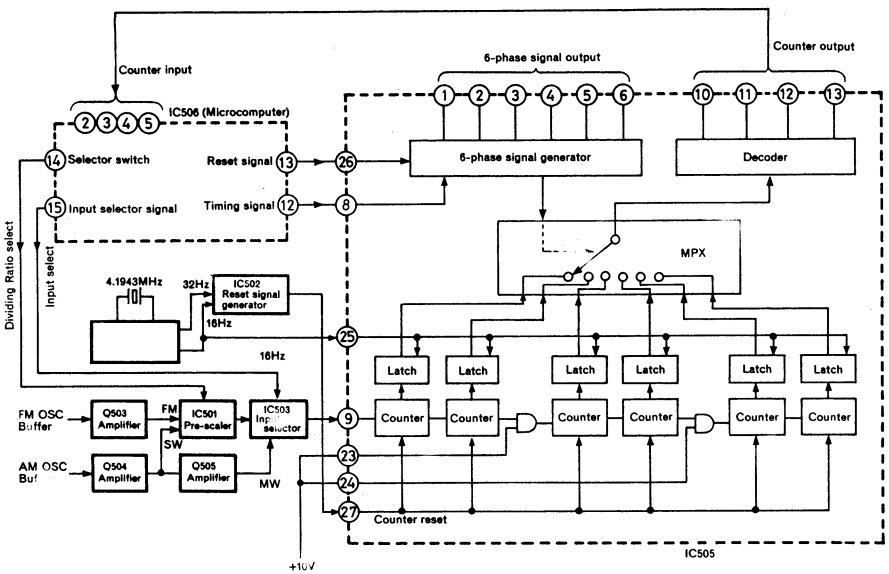


Fig. 7

Frequency counter timing

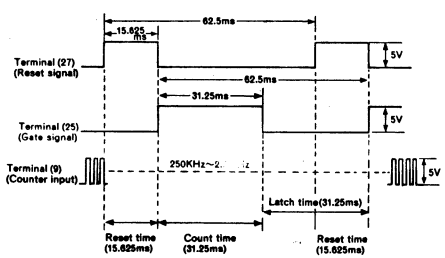


Fig. 8

6-phase signal timing

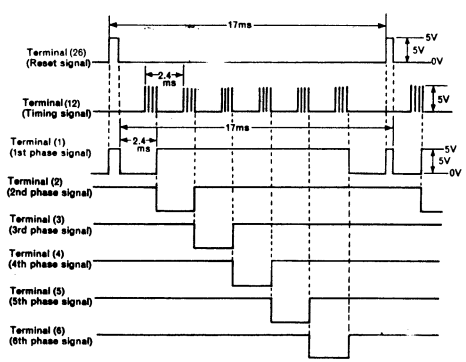


Fig. 9

IC505 is the frequency counter and 6-phase signal generator.

Frequency counter circuit

When this unit is changed over to the frequency indication mode, the dividing ratio during FM and SW is set to 1/40 during FM and to 1/20 during SW depending on the setting of the band selector switch for changing the frequency of the local oscillator. Next, the band selector signal is output to change over the frequency input during FM.SW/MW. The reset signal is obtained at terminal (27) of IC505 from the reference signal generator circuit, and the gate signal, to terminal (25), for timing of the count operation. (Shown in Fig. 8). When the reset signal is at H level for 15.625ms, the internal counter is reset. The gate signal rises simultaneously when the reset signal decays and stays at H level for 31.25ms. The pulses input from terminal (9) of IC505 are counted during this period. This counter is a 6-digit decimal counter and a latch circuit, which temporarily stores the data after completion of counting in each counter. With this latch circuit, terminal (25) resets memory at H level and the data is temporarily stored just before becomes L level. Data from each latch circuit is transferred to the microcomputer divided into 6 to match the timing of the 6-phase signal produced inside IC505. Terminal (23) (24) are always set to H level to operate the 6-digit decimal counter.

6-phase signal generator circuit

The dynamic lighting system, which lights each digit at specified intervals while synchronizing with the segment signals employed in the system lighting the display tube in this unit. The 6-digit signal is generated inside IC505 to scan this. This 6-digit signal is concurrently used as the timing signal for the clock function matrix switch and the data transfer timing signal of the frequency counter. The reference signal for the 6 digit signal is obtained from the microcomputer to synchronize the microcomputer and peripheral circuitry. As the reference signal from the microcomputer, 4 timing pulses are output from terminal (12) as shown in Fig. 9 every 2.4ms and the reset pulse from terminal (13) every 17ms. These outputs are input to terminals (8) and (26) of IC505. First, when the reset pulse is input to terminal (26), output terminals (1) – (6) of the 6-phase signal are set to H level from the rise time till just before the decay of the reset pulse. When the reset signal decays, the 1st phase (output terminal (1)) of the 6-phase signal is set to L level for 2.4ms, until the 4th timing pulse input from terminal (8) is input. Simultaneously, when the 1st phase rises to H level from L level, the 2nd phase output is set to L level for 2.4ms, until the 4th timing pulse is output from terminal (8). The same principle is applied to the 3rd, 4th, 5th and 6th phase. Then, when the reset pulse is input to terminal (26) again, the same operation is repeated, each phase is set to L level for 2.4ms every 17ms and scanned in sequence from the 1st phase.

3. Matrix switch circuit

The pushbutton switch is designed to operate the matirx circuit which performs detection depending on what phase of the 6-phase signal generated by IC505 is input to which of the 4 input terminals. That is to say, the operation buttons as shown in Fig. 10 are connected so as to short-circuit one 6-phase signal and one of terminals (33) – (36). (For example, when button (B) of the world clock is pressed, the 1st phase of the 6-phase signal is input to terminal (36) of IC6.) When more than 2 operation buttons are pressed, the first pressed has priority; when more than 2 buttons are pressed simultaneously, no operation takes place. A program is provided to prevent mis-operation because of chattering or noise. The dimmer switch is assumed to be ON when the 6th phase signal is input to terminals (33) and (34) simultaneously. Other matrix switch signals than the dimmer switch accept the operational input only when the dimmer display is in the clock display mode. Because of this, the display does not change when these buttons are pressed in the frequency display mode.

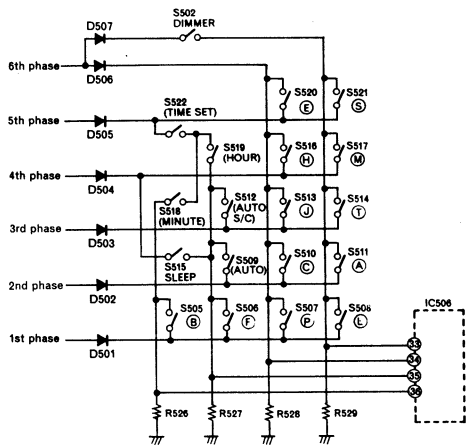


Fig. 10

4. Reduced voltage detector circuit

The display of this unit is controlled by the microcomputer depending on the mode. When the battery output falls below the rated voltage during the use of DC power supply, it is likely to be affected by noise and the microcomputer may malfunction. Accordingly, a reduced voltage alarm function which signals the reduced voltage just before it drops below the rated voltage, is provided. Fig. 11 shows the reduced voltage detector circuit. Terminal (8) of IC506 is set to H level when the power voltage is within the rating, and to L level when it is less than 30% of the rated voltage (approx. less than 10.5V). The voltage applied to the zener diode is higher than the zener voltage which is within the rated voltage, and the zener diode becomes active, so the base current of Q526 flows through R577 and the zener diode and Q526 turns ON. The voltage drops because of the collector current across R579 at that time, and terminal (8) of the microcomputer is set to H level. When the voltage drops to less than 30% of the rated voltage, it becomes lower than the zener voltage of the zener diode, so it becomes closed, Q525 turns OFF and the voltage drop of R579 stops, and terminal (8) of the microcomputer is set to L level. When terminal (8) is set to L level, the kHz or MHz indicator of the display flashes every 2 seconds controlled by the microcomputer program.

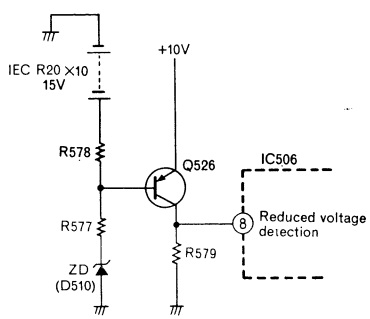


Fig. 11

5. Initial reset circuit

This circuit is so that the operation of the microcomputer starts at the beginning when power is first supplied to the microcomputer or when power for the microcomputer drops instantaneously for any reason and rises again to the operational voltage. Terminal (7) of the microcomputer is set to L level during general operation, but when the power is supplied for the first time or when the power drops and rises again, the voltage applied to the zener diode becomes larger than the zener voltage in the initial reset circuit as shown in Fig. 12, the inverse current becomes larger and the circuit is active so the base current of Q525 flows via R575 and ZD, and Q525 turns ON. Voltage drop occurs in R539 because of the collector voltage, and current flows through R567 until charging of C520 is complete. The voltage drop of R567 sets terminal (7) of IC506 to H level. When charging of C520 is complete, the voltage drop in R567 stops so terminal (7) of IC506 is set to L level. D508 is used for quick discharging when the power is turned OFF. Q525 is the switching transistor which prevents the charging current from flowing to C520 before the applied voltage becomes less than the zener voltage. When the applied voltage exceeds the zener voltage, Q525 turns ON and makes the voltage drop in R567 larger by making the charging current just after Q525 is turned ON larger. This transistor ensures that the reset signal generates even when the power rises gradually.

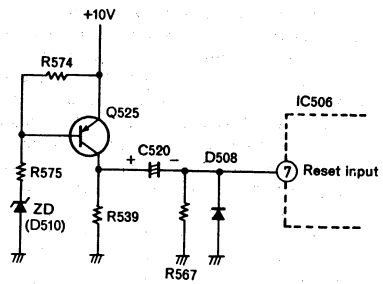


Fig. 12

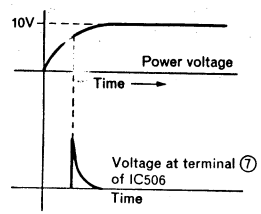


Fig. 13

6. m(meter) Display circuit

This circuit lights the "m" segment in m (meter) SW band display mode.
Terminal (15) of IC506 as shown in Fig. 14 is the output terminal to control the dividing ratio in the FM/SW mode. It is set to 5V in FM/MW mode and 10V in SW mode. Accordingly, Q502 turns ON during FM/MW mode and OFF during SW mode. In addition to this, Q501 turns ON during FM/MW mode and the 10V power supply is connected to the "m" segment of the display tube via Q501, R509, S501, S504, S502, so the "m" segment lights when scanned by the 6-phase signal.

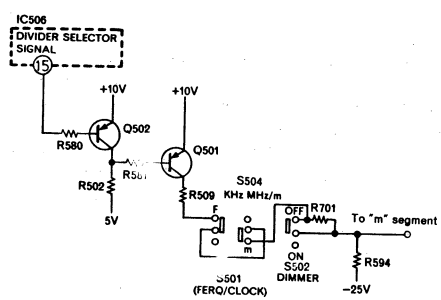


Fig. 14

7. 2nd decimal point and below erase circuit during FM reception

This circuit is provided so that the second decimal point and below do not light during FM reception. Terminal (15) of IC506 as shown in Fig. 15 is the output terminal controlling the dividing ratio; it is set to 5V during FM/MW reception and 10V during SW reception. Since the output voltage at terminal (15) is set to 5V during FM/MW reception, there is a potential difference between the Base and Emitter of Q502, Q502 turns ON and the NAND input terminal (8) of IC502 is set to H level because of the voltage drop in R502. Terminal (14) of IC506 is the band selector controlling terminal. It is 10V during FM/SW reception, and 5V during MW reception. Accordingly, output terminal (10) of IC502 is 5V only during FM reception when the two (2) inputs are at H level, so Q529 turns ON and keeps Q510 OFF. Accordingly, Q510 does not change even if the 5th phase of the 6-phase signal changes, so the lower 2nd digit of the display tube related to the 5th signal is always negatively biased, so it is not lit. The CLOCK/FREQ selector signal input terminal of D514 is fed 10V during the CLOCK display mode to prevent the digit from not being lit when the frequency is changed over to the CLOCK display mode during FM reception which turns Q502 OFF and sets terminal (8) of IC502 to L level.

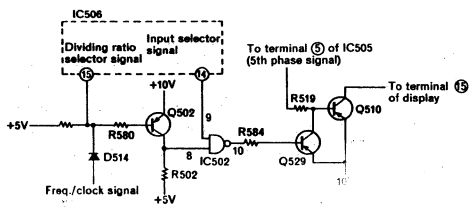
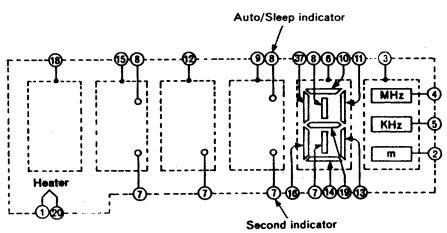


Fig. 15

8. Display tube drive circuit

The display tube is a direct-heating 3-pole vacuum tube composed of the plate, grid and filament; it is designed with the fluorescent substance coated onto the plate and the plate emits light only when plate current flows. Accordingly, it is required to control the current applied to the plate and grid for emitting light. Since the dynamic lighting system is used to drive the display tube, hold timing of the 6-phase signal applied to the grid and the segment signal applied to the plate, are matched and when a positive bias is obtained, the plate current flows and light is emitted. When the timing do not match, negative bias is applied to the grid and plate to prevent lighting. The dimmer function lights the segment signal for 2ms at 17ms interval when the dimmer is OFF. The segment signal is lit for 0.5ms at 17ms intervals when the dimmer is ON.



The terminals are numbered in sequence starting from the left side with the terminal of the display tube at the bottom.
Terminals (3), (6), (9), (12), (15), (18) are grid terminals.
Terminals (1) and (20) are heater terminals.
Other terminals are plate terminals.

Fig. 16

9. Frequency display mode

When terminal (37) of IC506 as shown in the block diagram is set to L level (S501: OFF, S401: ON), the frequency count signal transmitted from terminals (2) – (5) divided into 6 times synchronized with the 6-phase signal determines the band from the level of terminals (10), (11) and calculation of the band constant is performed. The calculated data is segment-coded and transmitted to the output buffer synchronized with the 6-phase signal and the display tube is driven. When the auto-display switch is ON (terminal (9) is at L level), when DC power supply (terminal (39) is at L level) is used and when the value of the lower 2 digits do not change for 10 sec, the segment output is not output and the display is not lit. When the power switch (S401) is turned OFF and when AC power supply is used, terminal (37) is set to L level, so the clock display mode is obtained automatically.

10. Meter display mode

When terminal (37) of IC506 as shown in the block diagram is at L level (S501: OFF, S401: ON), terminals (10), (11) are at H level (SW band) and terminal (40) is at H level (S501: ON), the frequency count signal transmitted from terminals (2) – (5) in 6 times synchronized with the 6-phase signal are compared with the number stored in each meter area. When it matches the number in a certain area, the meter band corresponding to the area is displayed.
When it does not match either of the areas, the segment output is not output and the display is not lit. However, "m" display lights.

11. Clock display mode

When terminal (37) of IC506 as shown in the block diagram is at H level (S501: ON, or S401: OFF), terminal (39) is at L level (S601: ON), 1 is added to the clock counter of the microcomputer with the rise of the 16Hz reference signal input from terminal (6). This operation was precedence over the frequency display mode and when the 16Hz signal rises, 1 is added to the clock counter. The clock counter is composed of 28 digits as shown in Fig. 17; it is classified in 4-digit sections from the top; 8 digits each are used for the Hour, Minute and Second. The lowest 4 digits count reference pulses below 1 second; when it counts up to 16, 1 is added to the second counter (5th digit from the bottom). When set to the clock display mode, the digits are classified in 4-digit intervals from the top digit into 6 groups, segment-coded and transmitted to the output buffer while synchronizing with the 6-phase signal.
The lowest 4 digits are not displayed.

Clock counter

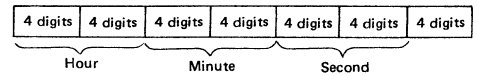


Fig. 17

12. World clock

Differences in time between 11 places and London have been prestored. When the button for a place other than London is pressed, the place corresponding to the pressed button is determined by the phase among 6 phases of the matrix switch circuit to be fed to one of terminals (33) – (36) of IC506, and the difference in time to GMT (Greenwich Mean Time) is added to the present time and the time is displayed in letters indicating the time is at that place regardless of the display.

13. AUTO function

A program to determine the output of the matrix switch circuit runs when this unit is set to the clock display mode. When the auto button (S512) as shown in Fig. 10 is pressed, the 3rd phase signal is input to terminal (35) of IC506 and the display indicates the auto-set time.
When the time set button (S522) and Hour button (S519) or Minute button (S518) are pressed simultaneously, the 5th phase signal is input to terminal (35) or terminal (36) and the auto-time varies every 0.3 sec. When the auto S/C button (S509) is pressed after the autotime is set, the 2nd phase signal is input to terminal (35), the auto-function operates and the present time and the auto-set time are compared every 1/16 sec. When the present time and the auto-set time are the same, the auto-sleep output terminal (17) is set to H level to turn Q521 ON and operates the relay. When this relay operates, power is applied to all circuits except the local oscillator circuit and sound is output. The local oscillator is supplied with power regardless of the standby switch when the power switch is turned ON, so stable reception is obtained at the auto-set time. Since the auto-on time is 60 minutes, when auto-on starts, 1/16 sec is deducted from the 60 minute timer every time the time is updated by 1/16 sec. When this 60 minute timer reaches "0", the auto-on output is set to L level and no sound is output. When the auto-set button is pressed before auto-on after auto-setting or during auto-on, the auto-function is cancelled. The auto-on set time, however, is stored as long as time-setting is not done. When the auto-function is operating, the auto-sleep indicator of the display stays lit until the auto-function is cancelled or until the 60 minute operation is complete after the auto-time setting. When SLEEP is set during auto-setting, the SLEEP indication

takes precedence, so the indicator flashes every 2 seconds and returns to the lit mode after the SLEEP time exceeds 60 minutes.

14. SLEEP function

When this unit is set to the CLOCK display mode, the program to determine the output of the matrix switch circuit owns. When the Sleep button (S515) as shown in Fig. 10 is pressed, the 4th phase signal is input to terminal (35) and the Sleep function is set for 60 minutes. At the same time, the Auto-Sleep indicator flashes every 2 seconds to show that the Sleep function is in operation. 1/16 sec is deducted from the internal 60 minute timer every time the time is updated by 1/16 sec, and when the timer reaches "0", the Auto/Sleep output is set to L level. The Sleep function is cancelled when the Sleep button is pressed during Sleep setting. When Sleep is set during Auto-On, since Sleep takes precedence, Auto-On is automatically cancelled, sound is output for 60 minutes starting at the time sleep is set. However, it is not cancelled during Auto-setting (when the Auto-On time is set to the time after Sleep operation is completed).

OPERATION AND CHANGING OUTPUT DURING NORMAL OPERATION

As shown in the block diagram, the microcomputer of this unit controls the display, frequency indication, meter band indication during SW band, world clock indication, auto-time indication during SW band, world clock indication, auto-time indication, reduced voltage alarm during DC operation, power failure alarm and Auto-Sleep operation indication, by means of various input signals. As a result, operating procedures are complex and correct operation might be misunderstood, so the indications and output changes caused by each normal operation are shown below for reference.

	Procedure Operation	Indication and output change
1	1) STANDBY: OFF 2) BFO: OFF 3) BAND: FM 4) DISPLAY SELECTOR: a) BRIGHT b) kHz/MHz c) CLOCK 5) AUTO DISPLAY: OFF 6) AC/DC: AC Turn ON the power switch with switches positioned as above.	• The display indicates "0 :00L" for 60 sec, and the whole display flashes every 2 seconds until the time setting operation is performed. The indication is updated by 1 minute after 60 sec. And, sound will be heard. • The above indications are performed with the plug inserted into the AC socket even if the power switch is OFF. However, no sound will be heard.
2	Press the Time Set button and Hour or Minute button simultaneously	• Flashing of the display stops only when the Time set button and the Hour button are pressed simultaneously and the time indication returns to "0" after updating the time from 0 to 23 at 300ms interval. • Flashing of display does not stop when the Time set button and minute button are pressed simultaneously. When it is updated by 59 minutes, the display shows "00" updating it by 1 hour. • When flashing of the display stops, the indicator shown below flashes every 2 seconds showing that the clock function is operating normally. 00 : 00 . L └ Flashes every 2 seconds
3	Turn the STANDBY switch ON	• The display indicates "I HOPE SUCCESS" flowing from right to left with each character lit at 300ms intervals and repeats this indication for 3 times. Even if the STANDBY switch is turned OFF halfway, the indication is repeated 3 times. Speaker sound is not output. However, when the STANDBY switch is turned OFF halfway, sound will be heard.
4	Press the world clock button when the display is indicating "00:00L".	• The following indications will be seem if world clock buttons shown below are pressed. Ⓛ button 00 : 00 L Ⓟ " 01 : 00 P Ⓒ " 05 : 30 C Ⓗ " 14 : 00 H Ⓔ " 19 : 00 E Ⓙ " 09 : 00 J Ⓢ " 16 : 00 S Ⓐ " 03 : 00 A Ⓜ " 10 : 00 m Ⓣ " 08 : 00 T ⓑ " 21 : 00 b Ⓕ " 00 : 00 F

	Procedure Operation	Indication and output change
		• When F button is pressed, indication of "00 : 00 F" may not be obtained. Set the difference in time after setting to "00 : 00 F" by the time setting operation.
5	Press the AUTO ON TIME button	Display indicates "00 : 00 . □" ↑ flashes every 2 seconds
6	Press the AUTO SET/CANCEL button	The Auto Sleep indicator lights. Press the button again, and the indicator lamp goes off. Sound is output for 60 minutes after the set time. The Auto Sleep indicator lamp goes off 60 minutes after the set time. 00 : 00 : L ↑ Auto Sleep indicator
7	Press the SLEEP SET/CANCEL button	The Auto Sleep indicator flashes every 2 seconds and sound is output for 60 minutes after the set time. Press the button further in the flashing mode, then the indicator goes off. When the Sleep is operated with the Auto function operating (Auto/Sleep indicator lit), the mode changes from Lit to Flashing. And when 60 minutes have elapsed, the Lit mode is obtained.
8	Press the TIME SET button and HOUR or MINUTE button simultaneously after pressing the AUTO ON TIME button.	As in Procedure 2), The AUTO ON time changes and the desired AUTO ON time can be set.
9	Press the DARK button of the DIMMER function	The display becomes dimmer.
10	STANDBY: OFF Changes over the Frequency mode to FM BAND	The display indicates the range of 88.0 – 108.0 MHz of the FM band. Radio sound is output.
11	Turn the TUNING SPEED DIAL	• Indication of the display changes. When the indication does not change when the dial is turned clockwise or counterclockwise, the upper or lower limit of frequency has been reached. The tuning mechanism is in the slip mode at that time. • Fine tuning is done by turning the Tuning Speed Dial while pulling it towards you.
12	Press the MW BAND switch	The display shows the range of 530 – 1,605 kHz of the MW band. Radio sound is output.
13	Press the SW_1 Band switch	The display shows the range of 3.0 – 7.0 MHz of the SW_1 BAND. Radio sound is output.
14	Press the SW_2 BAND switch	The display shows the range of 8 – 16 MHz of the SW_2 BAND. Radio sound is output.
15	Press the SW_3 BAND switch	The display shows the range of 16 – 30 MHz of the SW_3 BAND. Radio sound is output.

	Procedure Operation	Indication and output change
16	Press either of SW_1 – SW_3 BAND buttons to set to m BAND and tune.	The display shows the following reception frequency bands. SW_1 1) Indicates 90 m when the 3.2 – 3.4 MHz band is selected. 2) Indicates A 80 m when the 3.5 – 3.575 MHz band is selected. 3) Indicates 75 m " 3.9 – 4.0 MHz " 4) " 60 m " 1.750 – 4.995 MHz " 5) " JJY " 4.999 – 5.001 MHz " 6) " 60 m " 5.005 – 5.060 MHz " 7) " 49 m " 5.950 – 6.200 MHz " 8) " A40 m " 7.0 – 7.099 MHz " 9) " 41 m " 7.10 – 7.3 MHz " SW_2 10) Indicates 31 m when the 9.5 – 9.775 MHz band is selected. 11) Indicates JJY when the 9.999 – 10.001 MHz band is selected. 12) " 25 m " 11.7 – 11.975 MHz " 13) " 20 m " 14.000 – 14.350 MHz " 14) " JJY " 14.999 – 15.0001 MHz " 15) " 19 m " 15.1 – 15.45 MHz " SW_3 16) Indicates 16 m when the 17.7 – 17.9 MHz band is selected. 17) " A15 m " 21.0 – 21.449 MHz " 18) " 13 m " 21.450 – 21.750 MHz " 19) " 11 m " 25.6 – 26.1 MHz " 20) " Cb m " 26.968 – 27.144 MHz " 21) " A10m " 28 – 29.7 MHz " When a frequency out of the range given above is received, the indications other than "m" in the display go off. The indication "A" shows the amateur band, "JJY", Japan standard time broadcasting station and "Cb", the citizen band.
17	AC/DC switch: DC BAND: FM FREQ.: kHz/MHz AUTO DISPLAY: AUTO Turn the tuning knobs as shown above.	The display lights up when the tuning knob is turned. When the second digit of the frequency indication does not change for 10 sec after tuning is complete, the display goes off. Sound is output, not depending on the display indication.
18	AUTO DISPLAY: OFF	The display is indicated regardless of frequency change. Sound is output.
19	Set to CLOCK mode	Clock function does not operate when DC power supply is used.

Cautions

1. Operations mentioned in procedures 2) – 8) do not work when set to the frequency indication mode.
2. When the AUTO function is operated while using the SLEEP facility, the following indications and output are obtained (this is an unusual way to use the unit).
   1) When the Auto-On time is set within the Sleep time with both Sleep and Auto functions set, sound comes out for the time (Sleep operation time since Auto-On time + 30 minutes). Accordingly, when the Auto-On time is set approx. 1 minute later than the Sleep set time, sound comes out for 30 – 31 minutes after Sleep starts operation. When the Auto-On time is set approx. 1 minute before the completion of Sleep operation, sound comes out for 89 – 90 minutes after Sleep starts operation. The Auto/Sleep indicator flashes at 2 seconds intervals from the time the Sleep operated + 30 minutes.
   2) Auto function is set and it enters the same mode as in 1) when the Auto set button is pressed once when Sleep is set and Auto is not set, Auto-On time is set within the Sleep time and the set time and the present time are within 1 minute of each other. Radio sound is switched off when the Auto-set button is pressed twice (However, even though there is no sound, the Auto/Sleep indicator flashes every 2 seconds for 30 minutes from the time the Auto set button is pressed).

DISASSEMBLY

1. Top lid

Remove 13 top lid fixing screws shown in Fig. 18 and lift up the lid in the direction of the arrow.

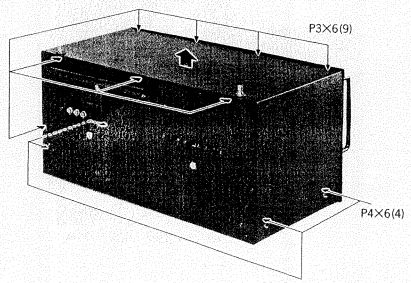


Fig. 18

2. Bottom lid

Remove the bottom lid to remove the front panel or to check PC Boards.

Remove 12 bottom plate fixing screws shown in Fig. 19.

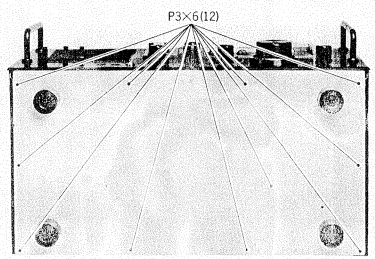


Fig. 19

3. Front panel

Remove all the knobs, etc. from the front panel, then remove 3 front panel fixing screws and 4 handle fixing nuts as shown in Fig. 20. Then, remove 3 fixing screws as shown in Fig. 21.

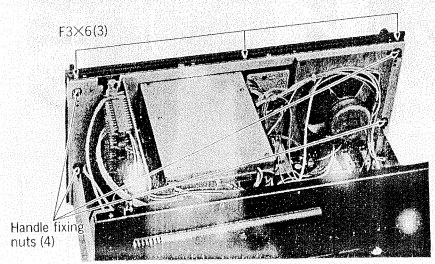


Fig. 20

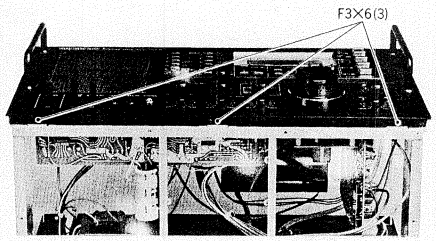


Fig. 21

4. Display panel

Remove 6 display panel fixing screws as shown in Fig. 22 and the connectors inserted into the display PC Board.

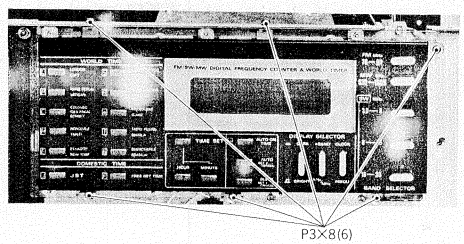


Fig. 22

5. Display PC board

The display PC Board is housed in a shielded case to prevent noise. Remove 4 matrix switch PC Board fixing screws, 5 shield cover fixing screws as shown in Fig. 23 and 4 PC Board fixing screws and nuts as shown in Fig. 24, and then lift the display PC Board as shown in Fig. 25 to take out it.

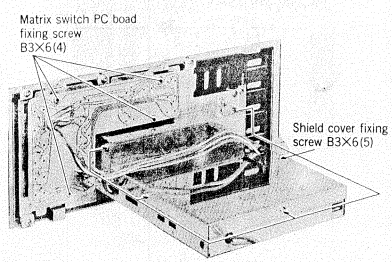


Fig. 23

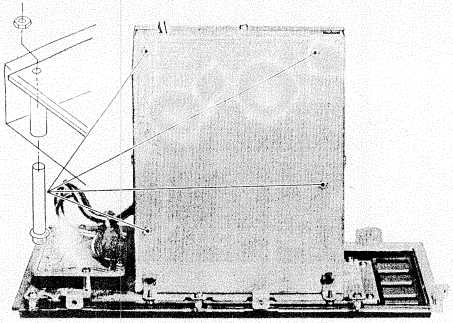


Fig. 24

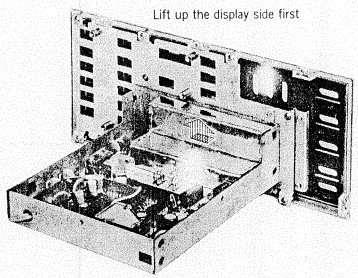


Fig. 25

6. Radio PC Board

Remove 2 band selector switch fixing screws, 2 VR fixing screws as shown in Fig. 26. And, 2 PC Board fixing screws through the chassis' side. Remove 3 variable capacitor fixing screws and wiring as shown in Fig. 27 to remove the radio PC Board.

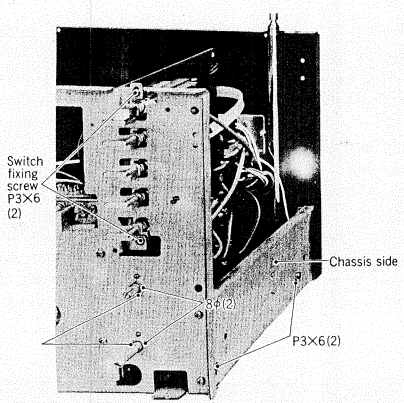


Fig. 26

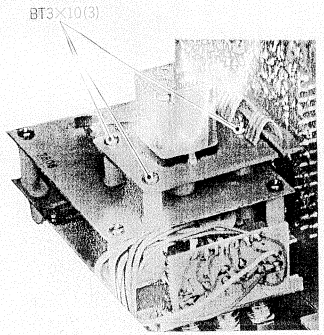


Fig 27

7. AF PC Board

Remove 6 AF PC Board fixing screws and 2 nuts as shown in Fig. 28. Then, remove 2 AF PC Board fixing screws as shown in Fig. 29.

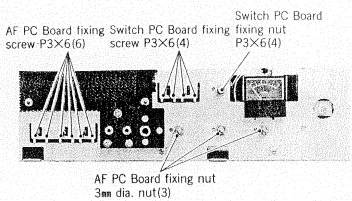


Fig. 28

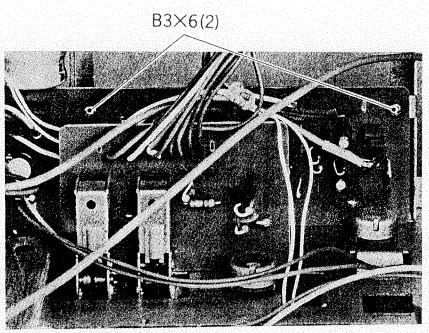


Fig. 29

8. Switch PC Board

Remove 4 switch PC Board fixing screws and 1 nut as shown in Fig. 28.

1. Reference oscillation frequency adjustment

The reference oscillation frequency is the standard for the reference time of the clock and for the gate time of the frequency counter, so it is precisely adjusted in the factory. If it has drifted, due to aging, etc., it is required to adjust the oscillation frequency.

Adjusting method (1) (Adjustment in factory)

1) Connect the frequency counter, which can measure up to the sensitivity of 1 Vrms, 0.1μs, between terminal (5) of IC502 and ground.
2) Adjust CT501 so that the value of the counter is 62499.8 – 62500.2μs.

Adjusting method (2) (When the frequency counter function of this unit is used)

Adjust CT501 so that the indication of the display shows 1,600 kHz when a signal of 2,055 kHz, approx. 200 mVrms is input to the AM oscillation frequency input terminal in the MW band (set the input frequency precisely using the frequency counter at this time). Next, check that the display shows the value, 455 kHz less than the input frequency when the input frequency is varied. With this adjustment method, the reference oscillation frequency can be adjusted more precisely as the input frequency is higher.

2. Microcomputer clock oscillation frequency adjustment

1) Connect the frequency counter to terminal (42) of IC506 via the 56 kΩ capacitor.
2) Adjust IFT501 so that the value of the frequency counter is 420 ±5 kHz.

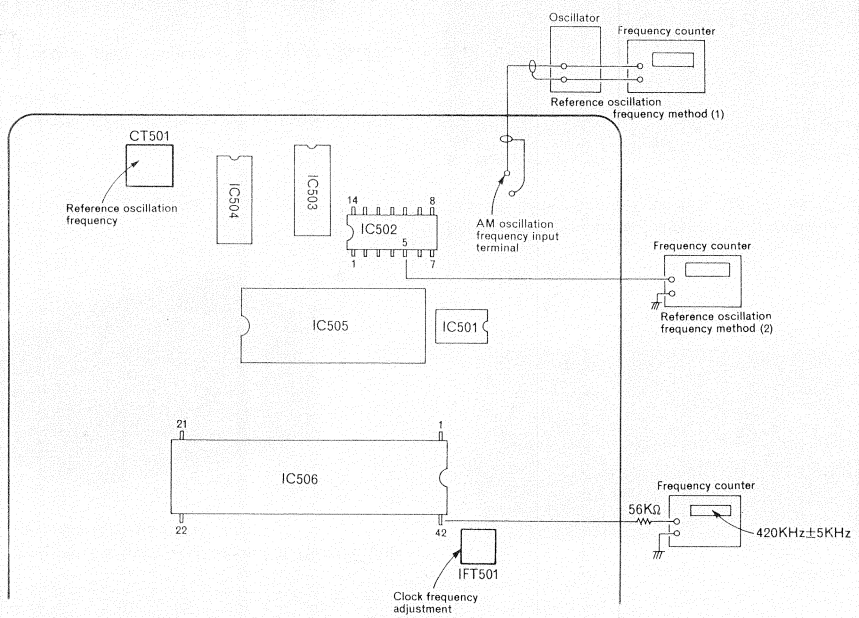


Fig. 30

KH-3800W

3. Adjusting radio section

Check the reference oscillation frequency before performing this adjustment.

Item No.		Adjustment item	Measuring instrument (Note (1))	Input terminal	Output terminal	Measured frequency: In ( ) shows counter scale	Adjusted position	Adjustment method
1	①	FM-IF	Genescope (10.7 MHz)	TP104		10.7 MHz (Note 1)	T101	Note 2
	②	FM Descri.					T102	Note 3
	③					Repeat 1 and 2		
2	①	FM Covering	———	———	———	(87.5 MHz)	L103	Note 4
	②					(109.0 MHz)	CT101	Note 5
	③					Repeat 1 and 2		
3	①	FM-ANT Tracking	FM Signal generator 400Hz, 30% Modulation 10 dB VTVM	TP102, 103	EAR Jack	90.0 MHz	L101	Note 6
	②					106.0 MHz	CT102	
	③					Repeat 1 and 2		
4	①	FM Tuning meter	FM Signal-generator 400 Hz, 30% 60 dB	Same as 3	——	98.0 MHz	RT101	Note 7
5	①	AM-IF	Genescope (455 kHz)	TP206	TP205	455 kHz	T204 T205 T206 T207 T208	Note 8
	②					Readjust the trimmer		
6	①	BFO	Genescope (455 kHz)	TP206	TP205	455 kHz	T209	Note 9
7		Set CT202, 204, 205, 206, 207 to the center of the variable range for adjusting item 8) and later						
8	①	MW-OSC Covering	———	———	———	(520 kHz)	L206	Note 4
	②					(1,650 kHz)	CT205	Note 5
	③					Repeat 1 and 2		
9	①	MW-ANT Tracking	AM signal generator 400 Hz, 30% modulation 42 dB VTVM	Ferrite antenna Connect the output of SG to the loop antenna and bring it nearer to the ferrite antenna	EAR Jack	600 kHz	L501	Note 6
	②					1,400 kHz	CT201	
	③					Repeat 1 and 2		
10	①	AM Tuning meter				1,000 kHz	RT203	Note 10

Item No.		Adjustment Item	Measuring Instrument (Note (1))	Input Terminal	Output Terminal	Measured frequency: In ( ) shows counter scale	Adjusted Position	Adjustment Method
11	①	SW-IF	AM signal generator (2.0 MHz) VTVM	External antenna terminal	EAR Jack	2 MHz (4.5 MHz)	T203 T202 T201	Note 11
	②							
12	①	SW_1 Covering	———	———	———	(2.9 MHz)	L207	Note 4
	②					(7.4 MHz)	CT206	Note 5
	③					Repeat 1 and 2		
13	①	SW_1-ANT Covering	AM signal generator 400 Hz, 30% modulation VTVM	External antenna terminal	EAR Jack	3.3 MHz	L203	Note 6
	②					5.6 MHz	CT202	
	③					Repeat 1 and 2		
14	①	SW_2-OSC Covering	———	———	——	(6.7 MHz)	L208	Note 4
	②					(16.5 MHz)	CT207	Note 5
	③					Repeat 1 and 2		
15	①	SW_2-ANT Tracking	AM signal generator 400 Hz, 30% modulation VTVM	External antenna terminal	EAR Jack	7.8 MHz	L204	Note 6
	②					14 MHz	CT203	
	③					Repeat 1 and 2		
16	①	SW_3-OSC Covering	———	———	———	(15.5 MHz)	L209	Note 4
	②					(31.0 MHz)	CT208	Note 5
	③					Repeat 1 and 2		
17	①	SW_3-ANT Tracking	AM signal generator 400 Hz, 30% modulation VTVM	External antenna terminal	EAR Jack	18.0 MHz	L205	Note 6
	②					28.0 MHz	CT	
	③					Repeat 1 and 2		

Note 1

Use the larger input for rough adjustment and reduce the input as adjustment advances.

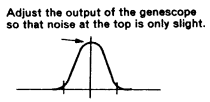


Fig. 31

Note 2

Pull out the core of T102 and input the weak 10.7 MHz input signal through the genescope.
Adjust T11 so that the gain is max. to obtain the waveform as shown in Fig. 31. When the center of the waveform and the marker cannot be matched, try to balance the left and right.

Note 3

Adjust T102 to obtain the S waveform shown in Fig. 32. In this case, adjust so that A and B are symmetrical to point C and linearity can be obtained.

Note 4

Turn the tuning knob fully counterclockwise and adjust the core so that the frequency indication is as shown in the table when the frequency variation stops at the point where frequency is max.

Note 5

Turn the tuning knob fully clockwise and adjust the trimmer so that the frequency indication is the same as the frequency indication on the display when the frequency indication is max. and variation stops.

Note 6

Tune so that the frequency indication of the display is as the value shown in the table and adjust so that the output is max. when the input from the antenna is set to the same value as the frequency indication.

Note 7

Input the signal shown in the table after FM IF adjustment, tune and then adjust RT101 so that the tuning meter swings to "5".

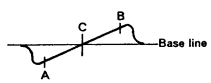


Fig. 32

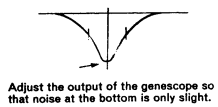


Fig. 33

Note 8

Input the weak 455 kHz input signal through the genescope. Adjust T204, T205, T206, T207, T208 to obtain the waveform shown in Fig. 33. When the waveform and the marker do not match, try to balance the right and left sides. Change over the WIDE/NARROW switch to NARROW and set the RF-GAIN knob to the max. point in the clockwise direction.

Note 9

Set the PITCH control knob to the center of its variable range after AM IF adjustment, then adjust T209 so that beats occurs at 455 kHz when the BFO switch is turned ON.

Note 10

Input the signal shown in the table to tune, after AM IF adjustment, then adjust RT203 so that the tuning meter indicates the mid-point 4 and 5.

Note 11

Press the SW_1 band switch and tune around 4.5 MHz, which frequency is roughly at the center of the SW_1, band connect the dummy antenna to the external antenna terminal and input 2 MHz, 100 dB. Adjust T201, T202, T203 to obtain the max. output having set the SW CAL knob to the center of its variable range.

Adjustment Parts Location

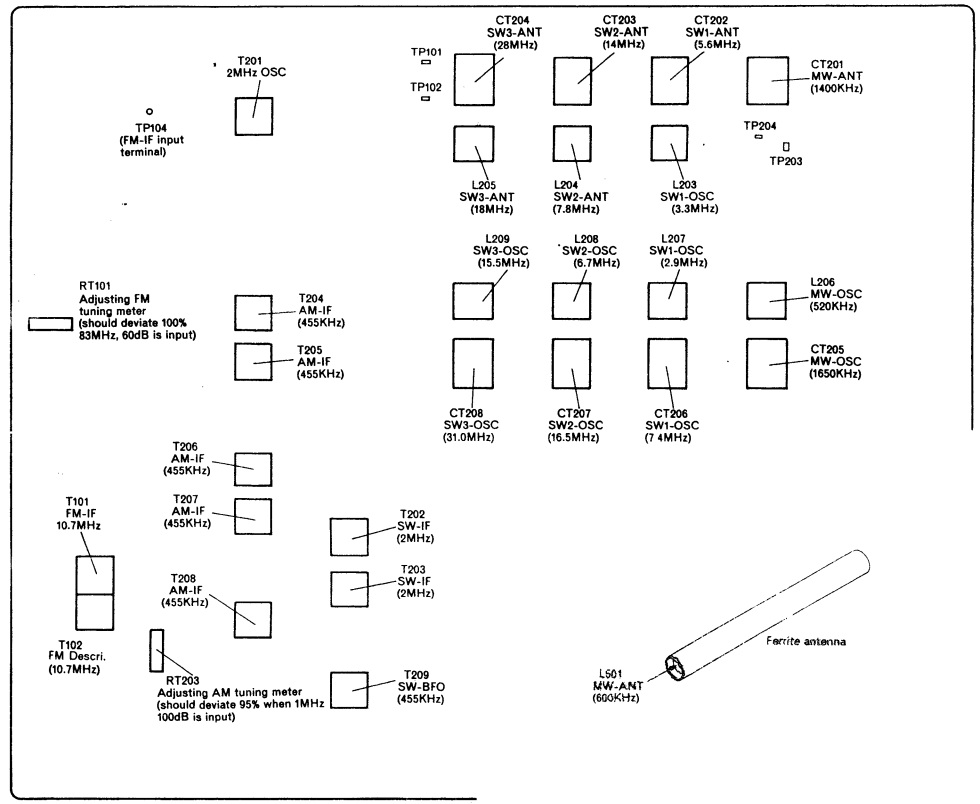


Fig. 34

Note

1. Voltage measured at base of chassis with minimum volume control and no signal.
2. Nomenclature of Resistors and Capacitors.

R101 150 RS·1·K

Circuit No.	
Value	No indicated Ω(Ohm) M : 1000kΩ
Tolerance	No indicated ±5% K : ±10% M : ±20%
Wattage	No indicated ¼W
Sort	No indicated Carbon film RC : Composition RW : Wire wound RS : Oxide metal film RN : Fixed metal film

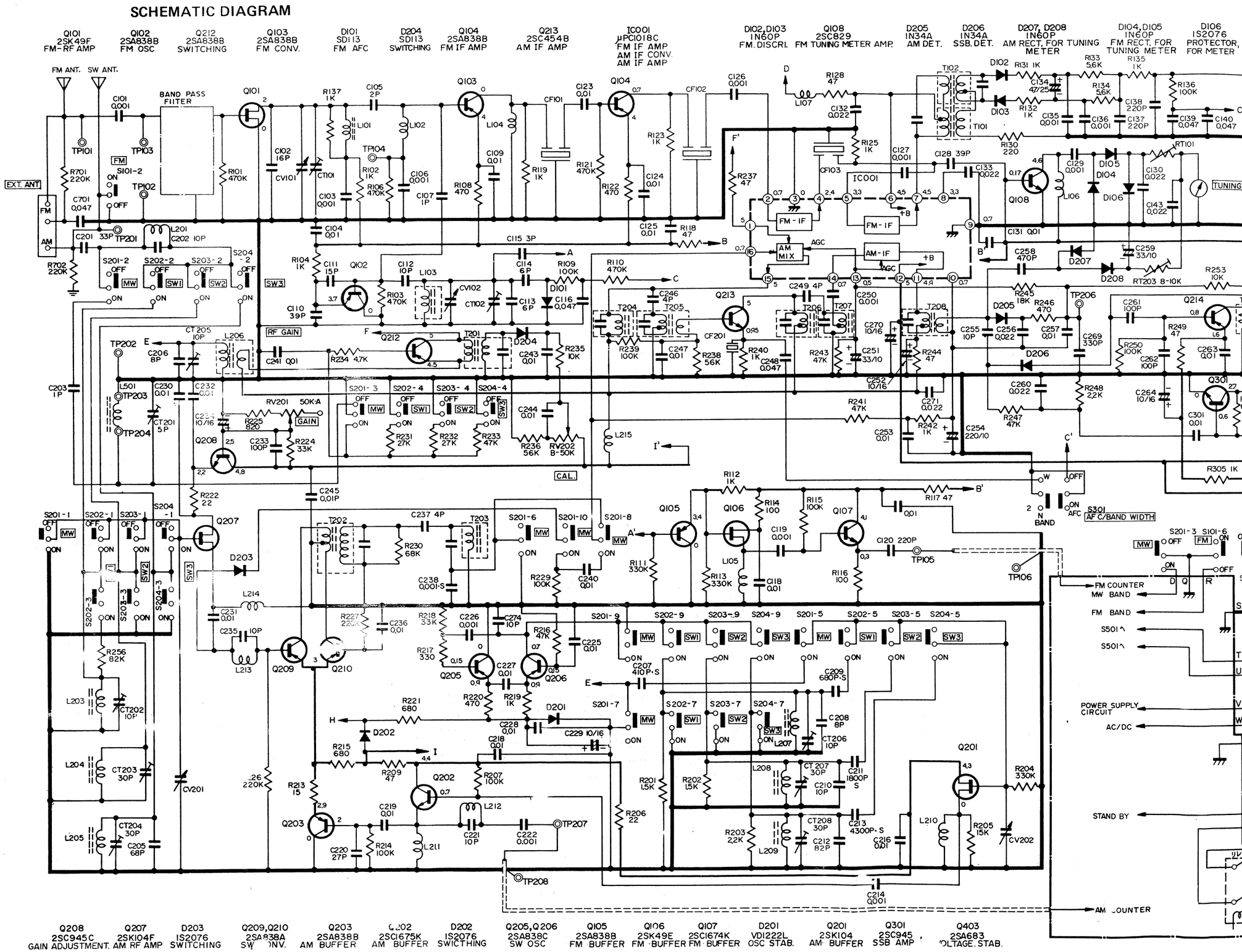
C101 0.001·M

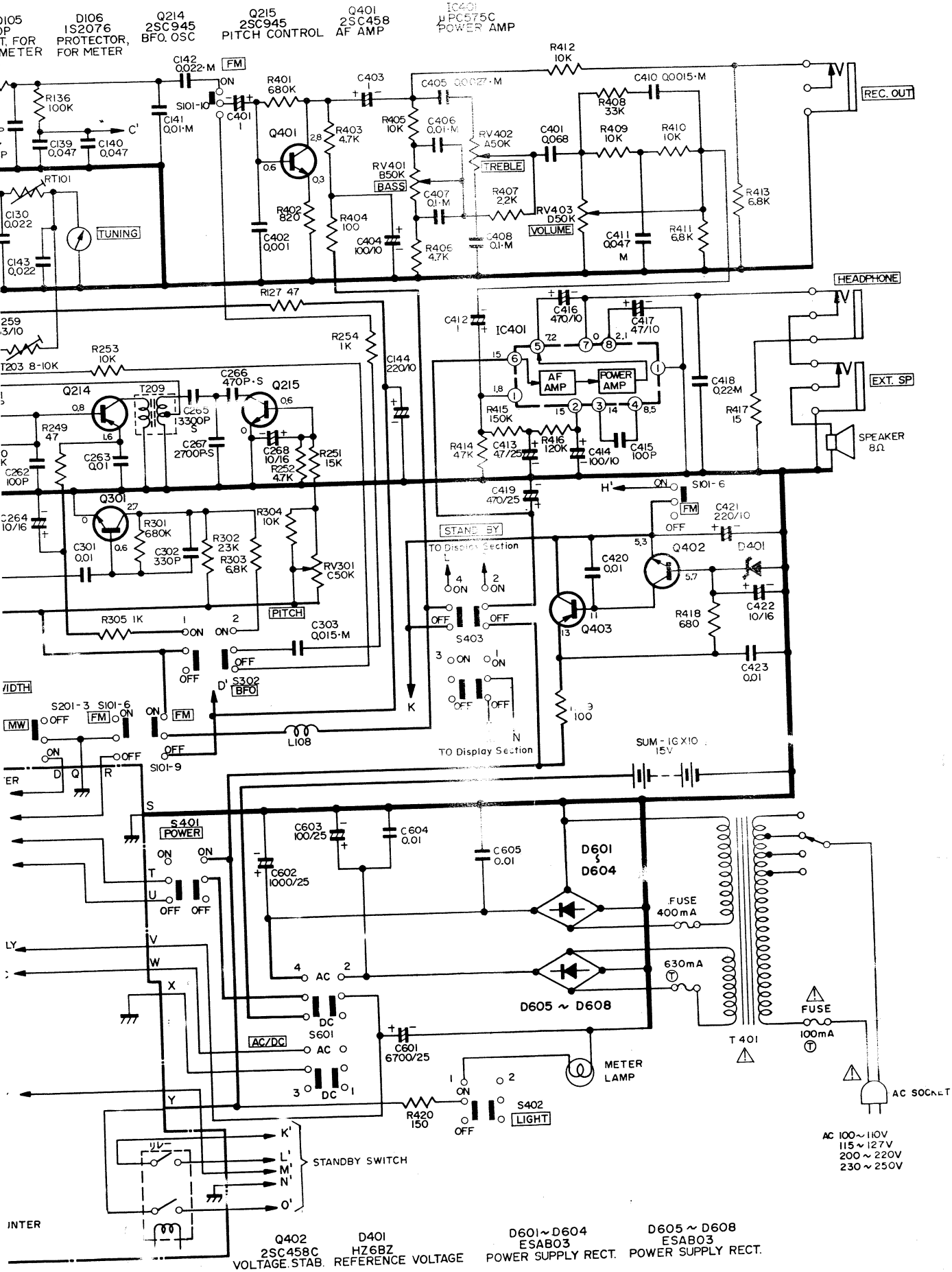
Circuit No.		
Value	No indicated μF P : PF	
Tolerance	No indicated ±10% J : ± 5% M : ±20% Z : +80%, −20% D : ±0.5pF C : ±0.25pF	
Sort		Ceramic
		Electrolitic
		Mylar
		Polyester
		Styrol
Voltage	No indicated 50WV	

C102 0.1/16-

3. Be sure to make your orders of resistors and capacitors with value, voltage, tolerance and sort.
4. When replacing capacitors marked with ✻, use specified ones stated on parts list since required temperature characteristics.

SCHEMATIC DIAGRAM





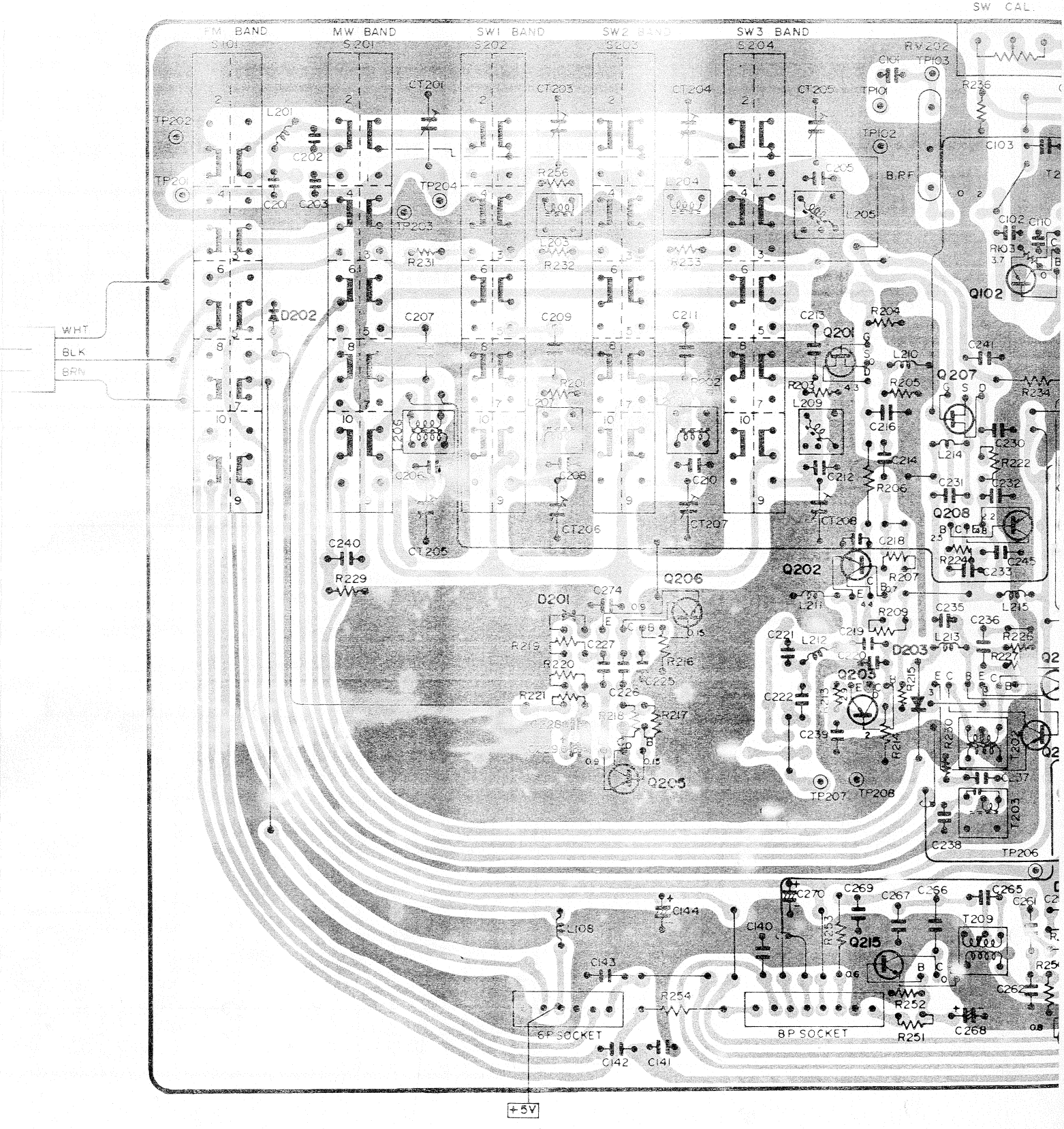
Q402 2SC458C VOLTAGE STAB.

D401 HZ6BZ REFERENCE VOLTAGE

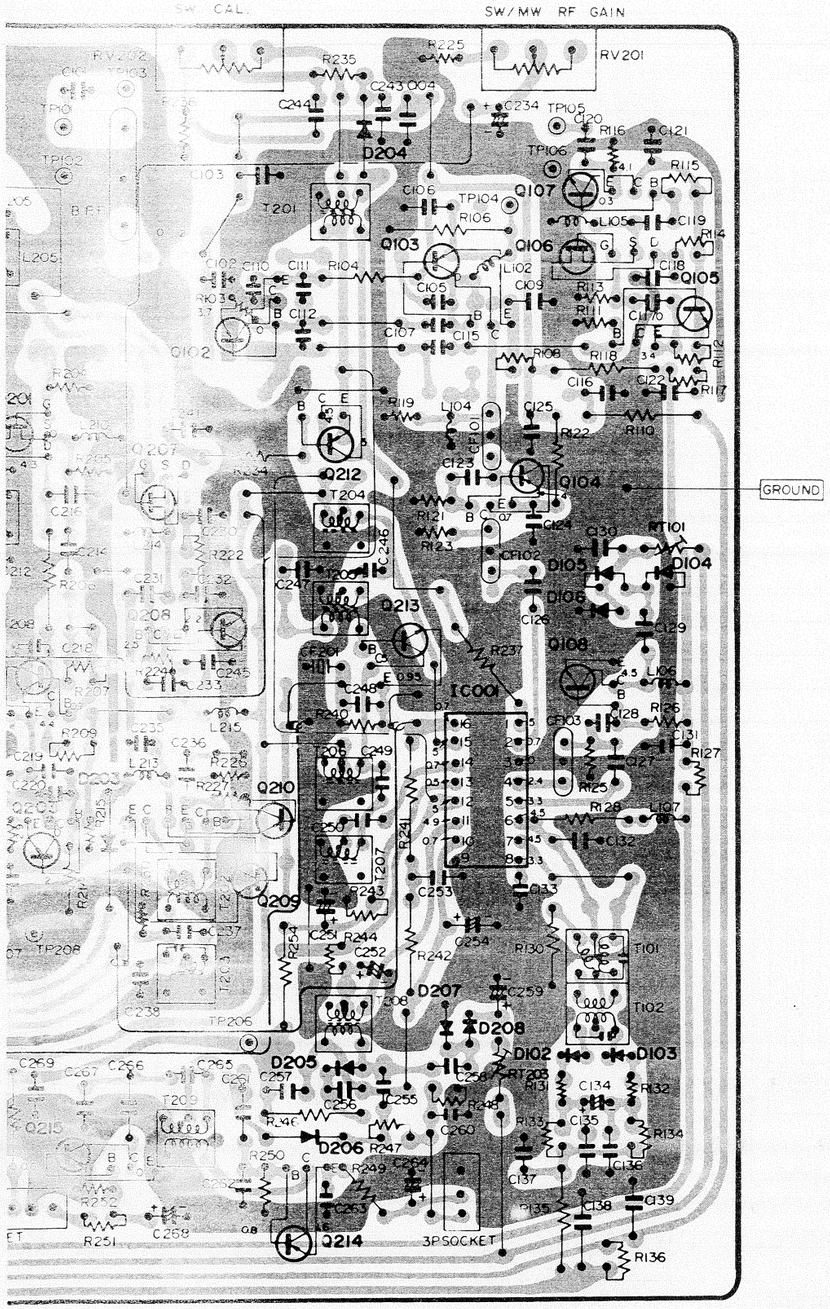
D601~D604 ESAB03 POWER SUPPLY RECT.

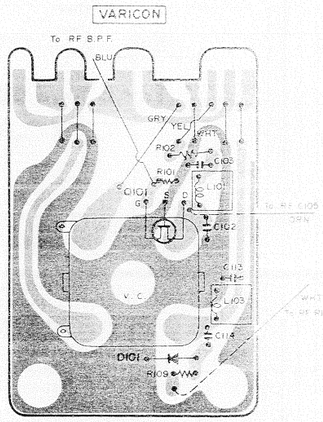
D605~D608 ESAB03 POWER SUPPLY RECT.

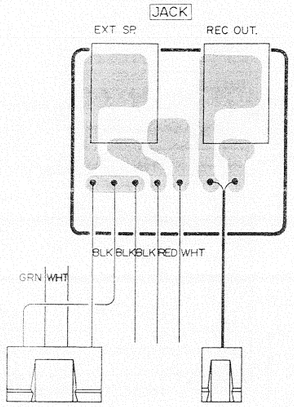
CIRCUIT BOARD DIAGRAM

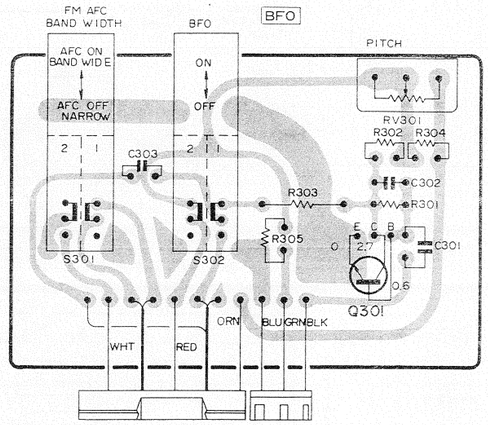


: Ground : Signal +B



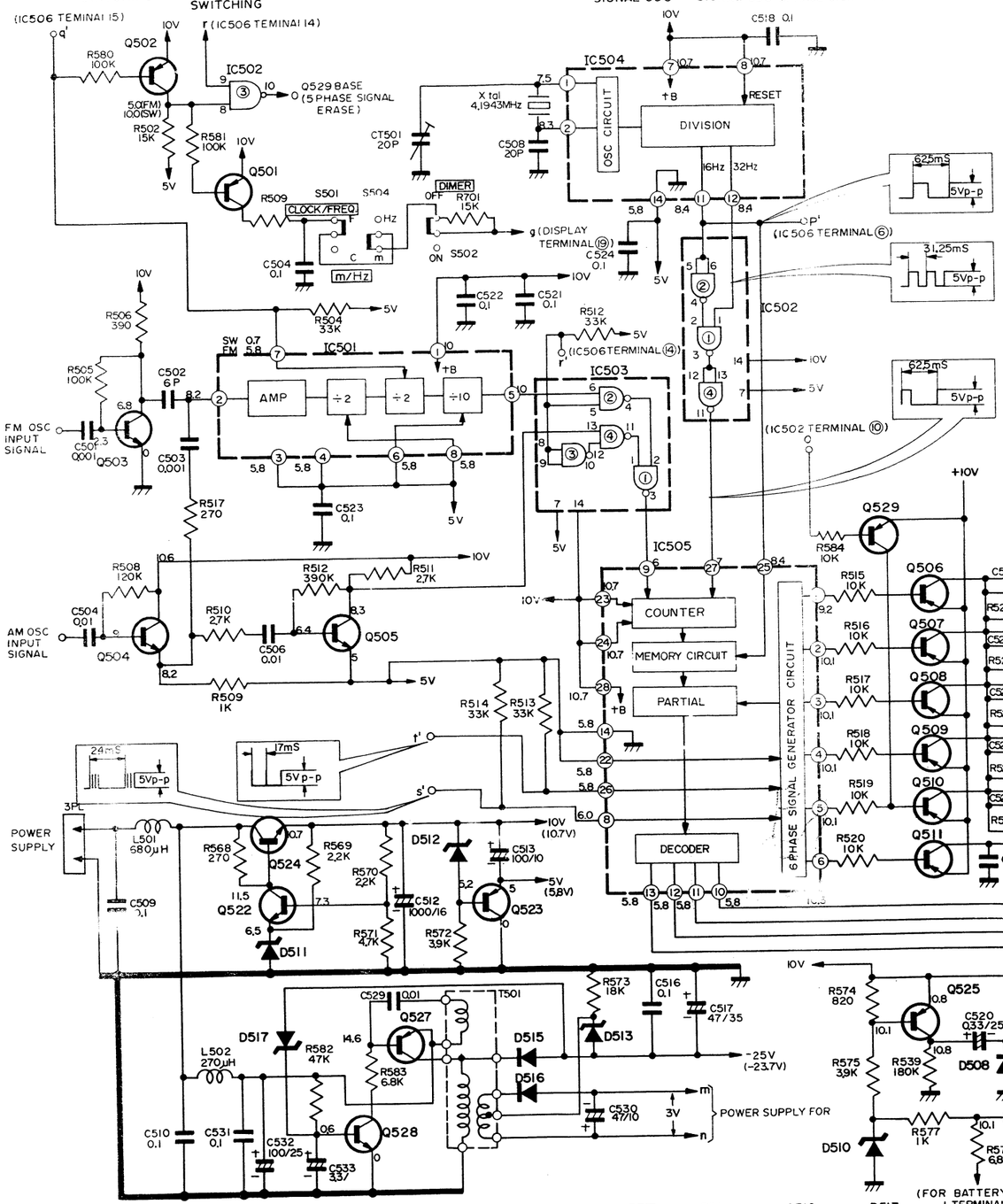






SCHEMATIC DIAGRAM (DISPLAY)

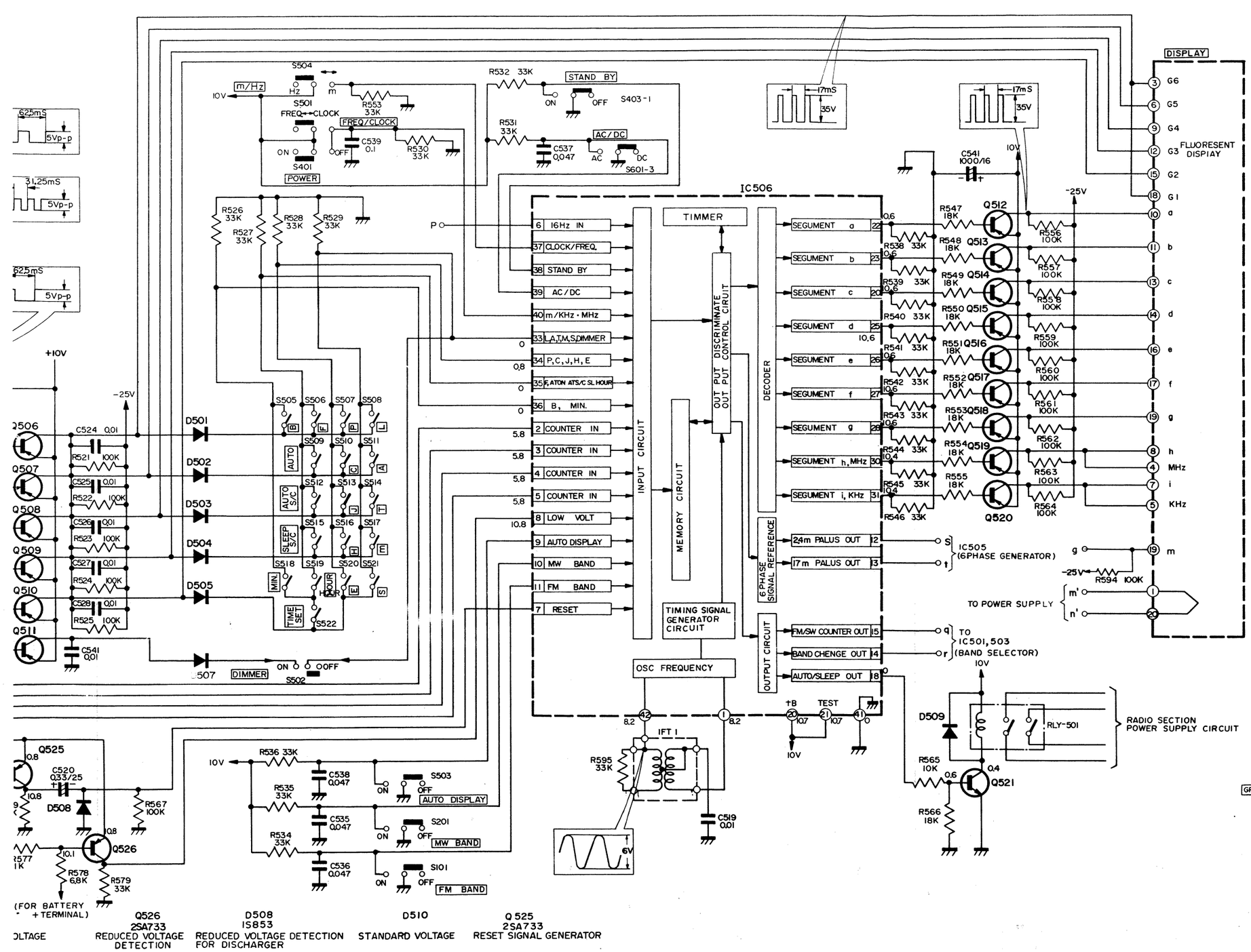
Q502 2SA733 SWITCHING
Q501 2SA733 "m" DISPLAY SWITCHING
IC501 μPB551C FM/SW DIVISION
Q503 2SC1674 AMP
IC503 μPD4011 INPUT SELECTOR
IC504 MSM5564 REFERENCE SIGNAL OSC
IC502 μPD4011 RESET SIGNAL OSC
IC505 TC5032P FREQUENCY COUNTER 6PHASE SIGNAL GENERATOR
Q504 2SC1674 AMP
Q505 2SC945 AMP
Q506~Q511 2SA733X7 6PHAS SIGNAL SWITCHING
D501~D507 IS853 X7 RECT.
Q529 2SA733 2ND DECIMAL POINT AND BELOW ERASE FM RECEPTION
IC506 μPD546 DISPLAY CONTROL AUTO/SLEEP SWICHING
Q512~Q520 2SA733 X9 SEGUMENT SWITCH
D509 IS853 TRNASISTOR PROTECTOR
Q521 2SC945 OUTPUT CONT. FOR AUTO/SLEEP



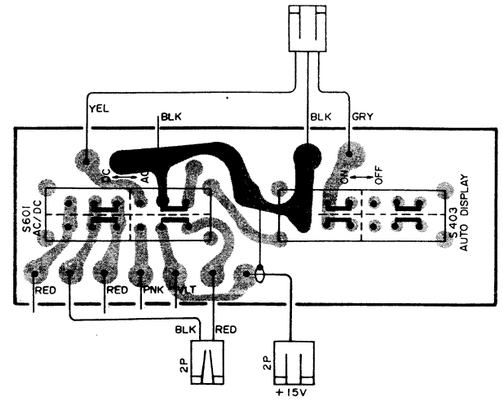
Q524 2SC1568 VOLT. CONT.
Q523 2SA952 VOLT. CONT.
Q522 2SC945 VOLT. CONT.
Q527 2SA684 OSC
Q528 2SC945 OSC VOLT. CONT.
D511 HZ7A2
D512 HZ6B2
D517 HZ-24-2
STANDARD VOLTAGE
D515 IS853 RECT
D516 IS853 RECT
D513 6B2 STANDARD VOLTAGE
Q526 2SA733 REDUCED VOLTAGE DETECTION
D508 IS853 REDUCED VOLTAGE DETECTION FOR DISCHARGER
D510 STANDARD VOLTAGE
Q525 2SA733 RESET SIGNAL GENERATOR

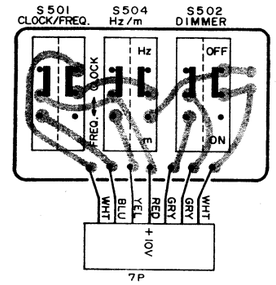
Q504 2SC1674 AMP
Q505 2SC945 AMP
Q506~Q511 2SA733X7 6PHAS SIGNAI SWITCHING
D501~D507 IS853X7 RECT.
Q529 2SA733 2ND DECIMAL POINT AND BELOW ERASE FM RECEPTION
IC506 μPD546 DISPLAY CONTROL AUTO/SLEEP SWICHING
Q512~Q520 2SA733X9 SEGUMENT SWITCH
D509 IS853 TRNASISTOR PROTECTOR
Q521 2SC945 OUTPUT CONT. FOR AUTO/SLEEP

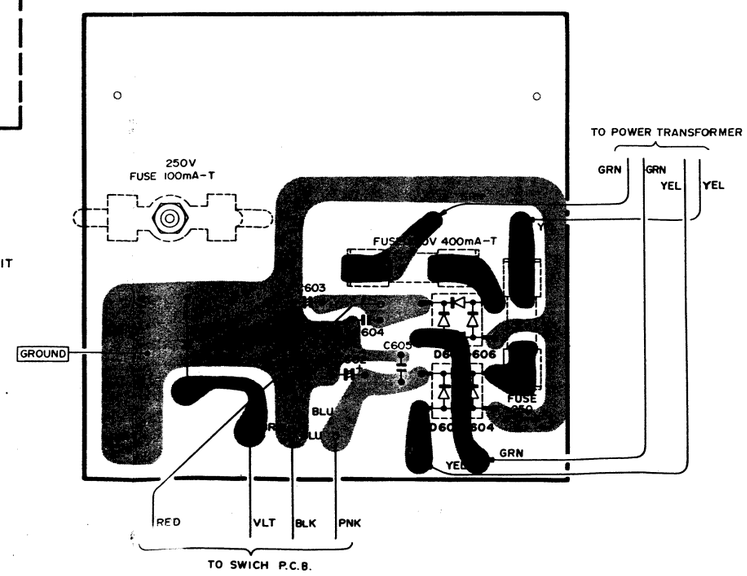
RATOR



Q526 2SA733 REDUCED VOLTAGE DETECTION
D508 IS853 REDUCED VOLTAGE DETECTION FOR DISCHARGER
D510 STANDARD VOLTAGE
Q525 2SA733 RESET SIGNAL GENERATOR

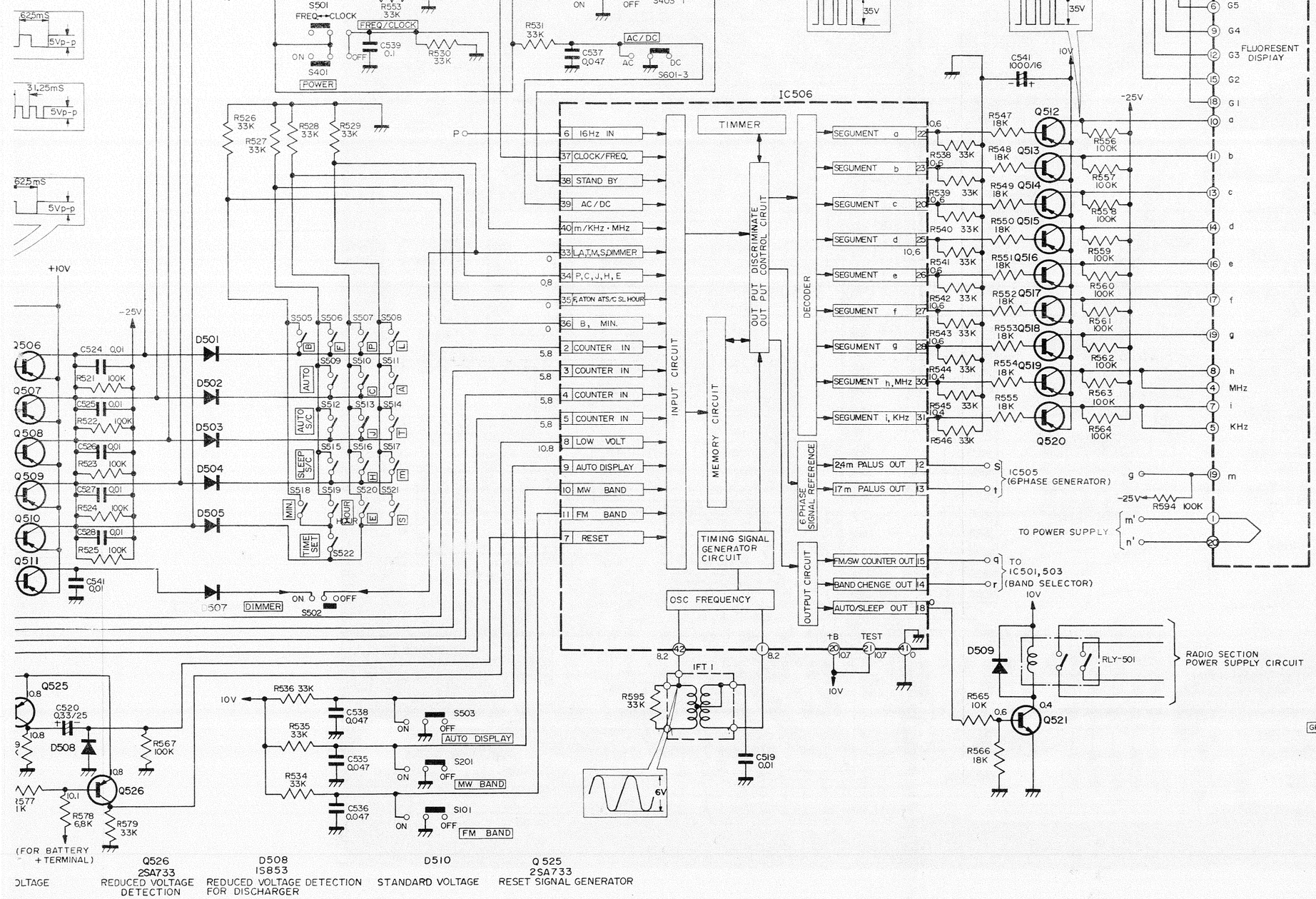






Q504 2SC1674 AMP
Q505 2SC945 AMP
Q506~Q511 2SA733X7 6PHAS SIGNAL SWITCHING
D501~D507 IS853 X7 RECT.
Q529 2SA733 2ND DECIMAL POINT AND BELOW ERASE FM RECEPTION
IC506 μPD546 DISPLAY CONTROL AUTO/SLEEP SWICHING
Q512~Q520 2SA733 X9 SEGUMENT SWITCH
D509 IS853 TRNASISTOR PROTECTOR
Q521 2SC945 OUTPUT CONT. FOR AUTO/SLEEP

RATOR



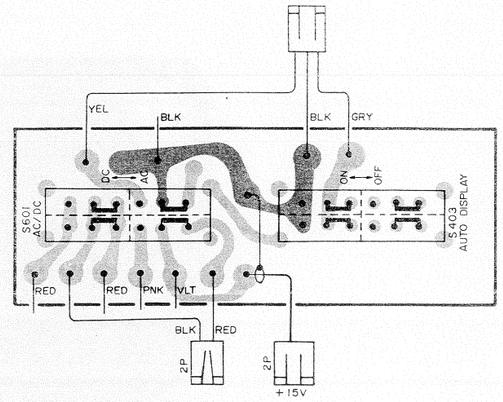
(FOR BATTERY + TERMINAL)

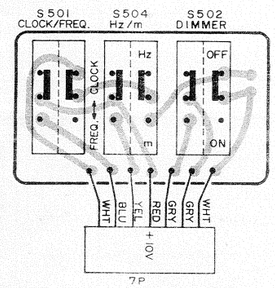
Q526 2SA733 REDUCED VOLTAGE DETECTION

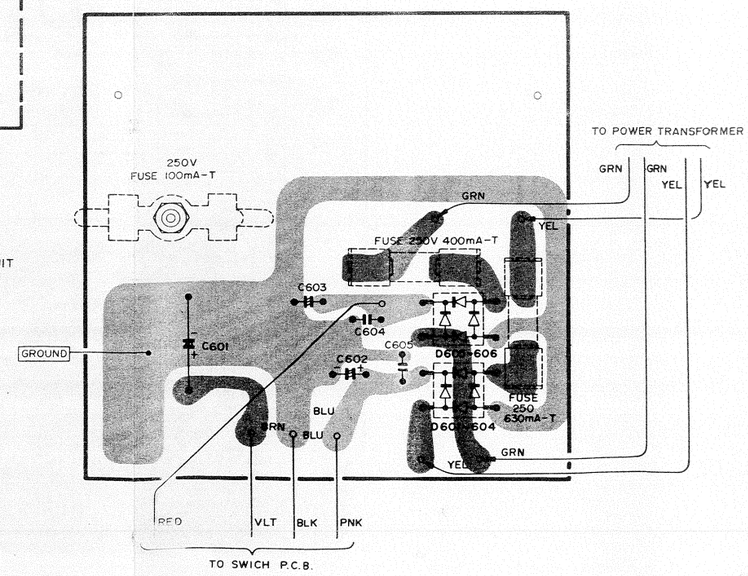
D508 IS853 REDUCED VOLTAGE DETECTION FOR DISCHARGER

D510 STANDARD VOLTAGE

Q525 2SA733 RESET SIGNAL GENERATOR

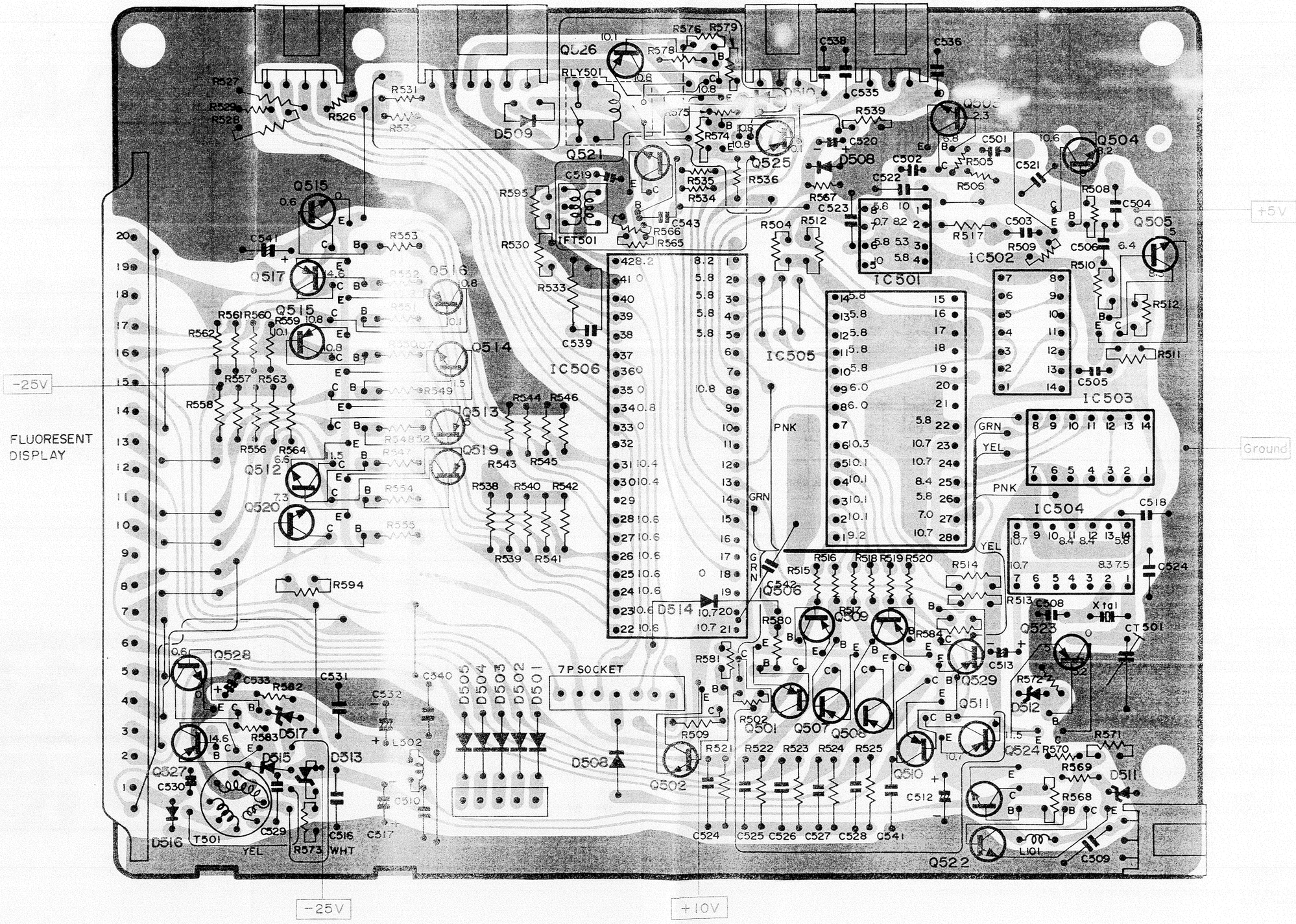


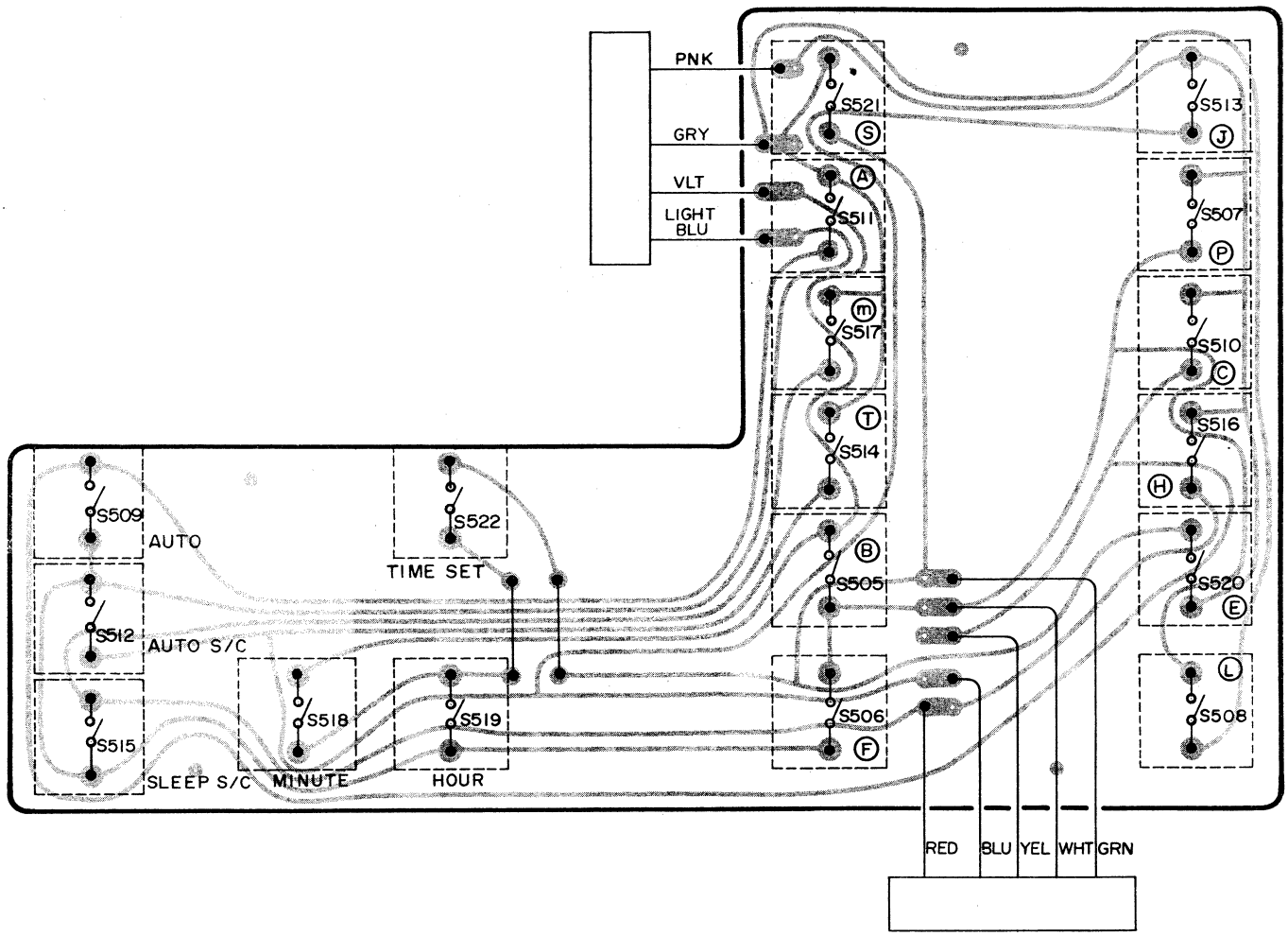




CIRCUIT BOARD DIAGRAM

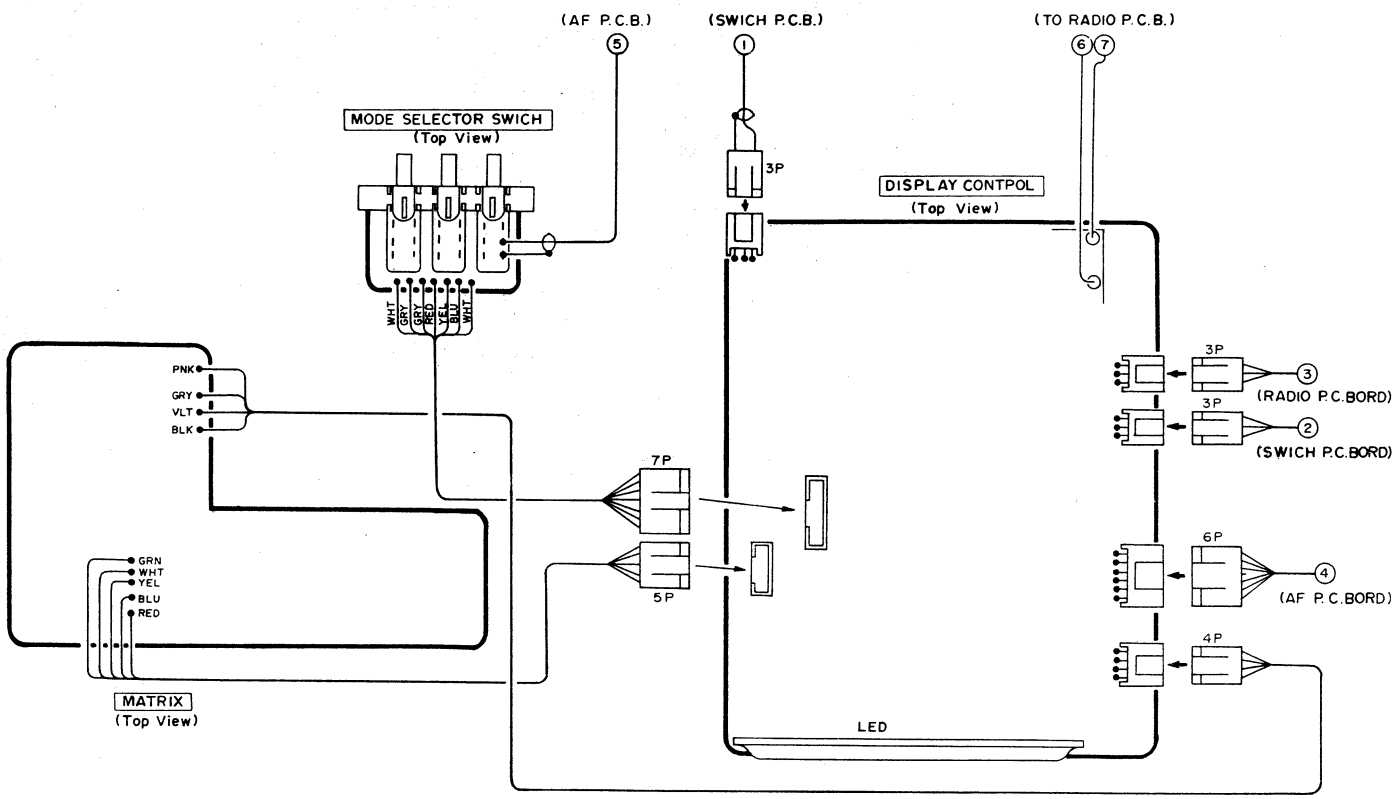
: Ground : Signal +B



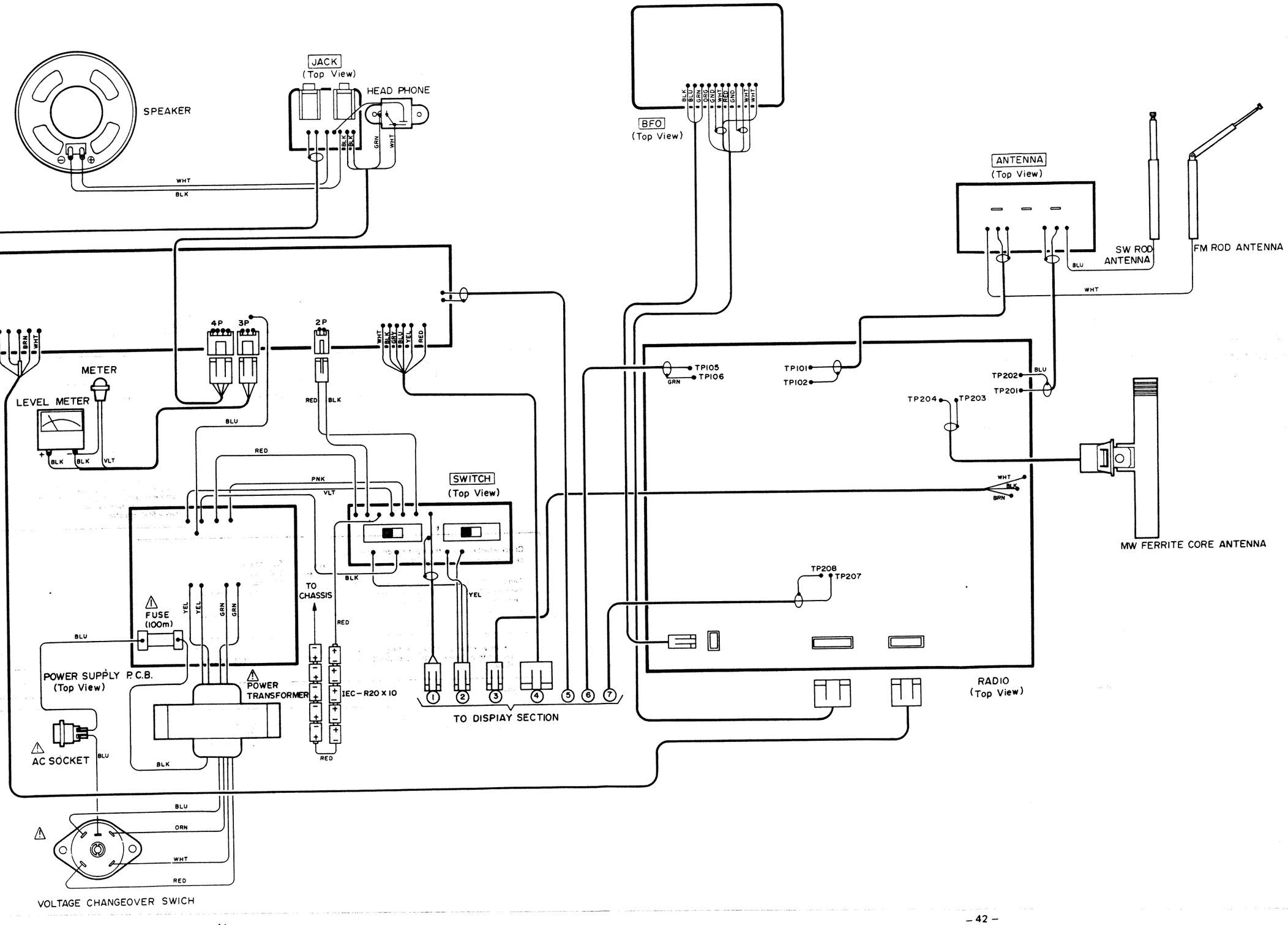

PNK
GRY
VLT
LIGHT BLU
S521
S
A
S511
m
S517
T
S514
B
S505
S506
F
S513
J
S507
P
S510
C
S516
H
S520
E
L
S508
S509
AUTO
S512
AUTO S/C
S515
SLEEP S/C
S518
MINUTE
S522
TIME SET
S519
HOUR
RED
BLU
YEL
WHT
GRN

WIRING DIAGRAM

1. Display Section



2. Radio/Power Section

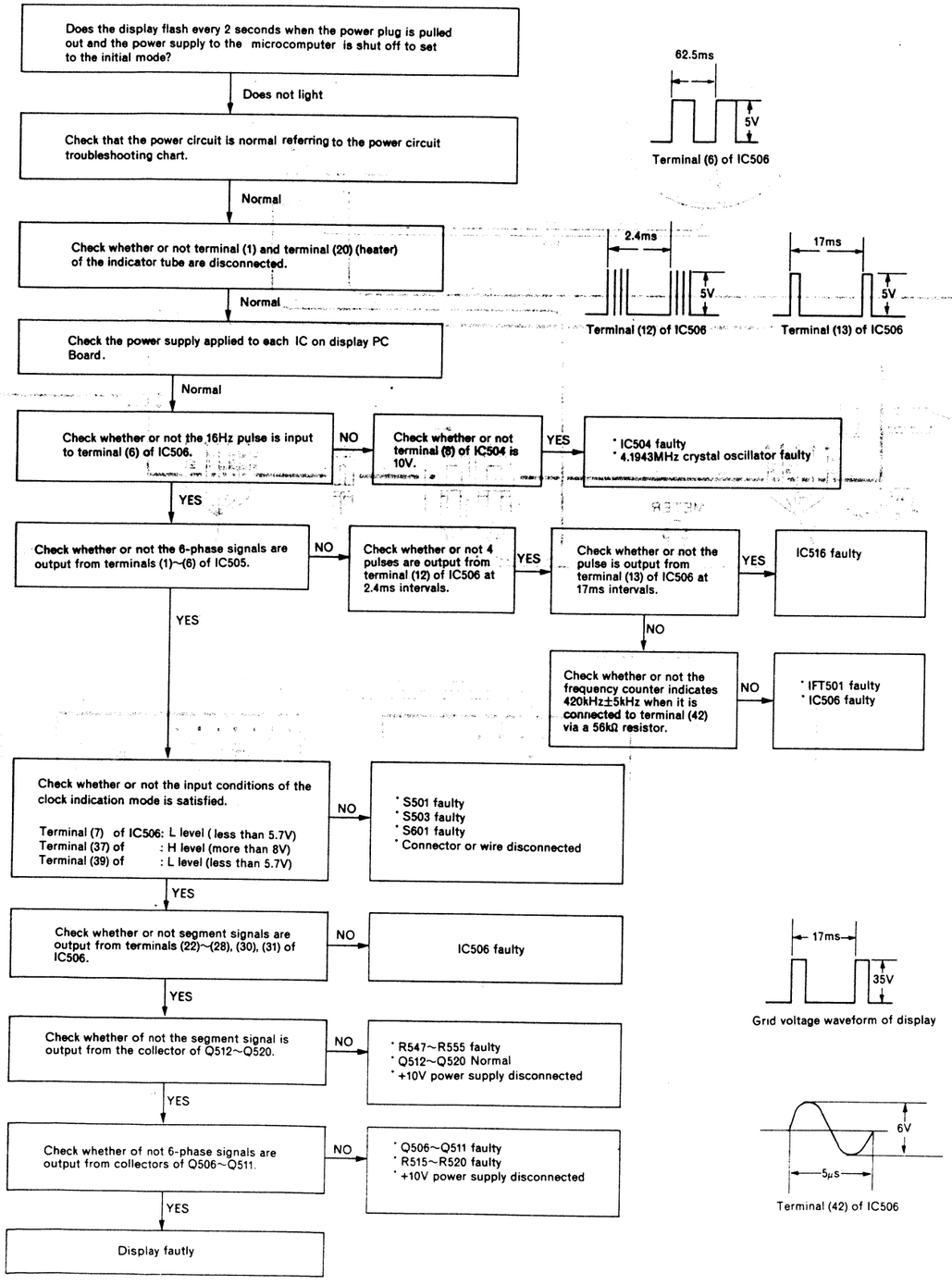


TROUBLESHOOTING

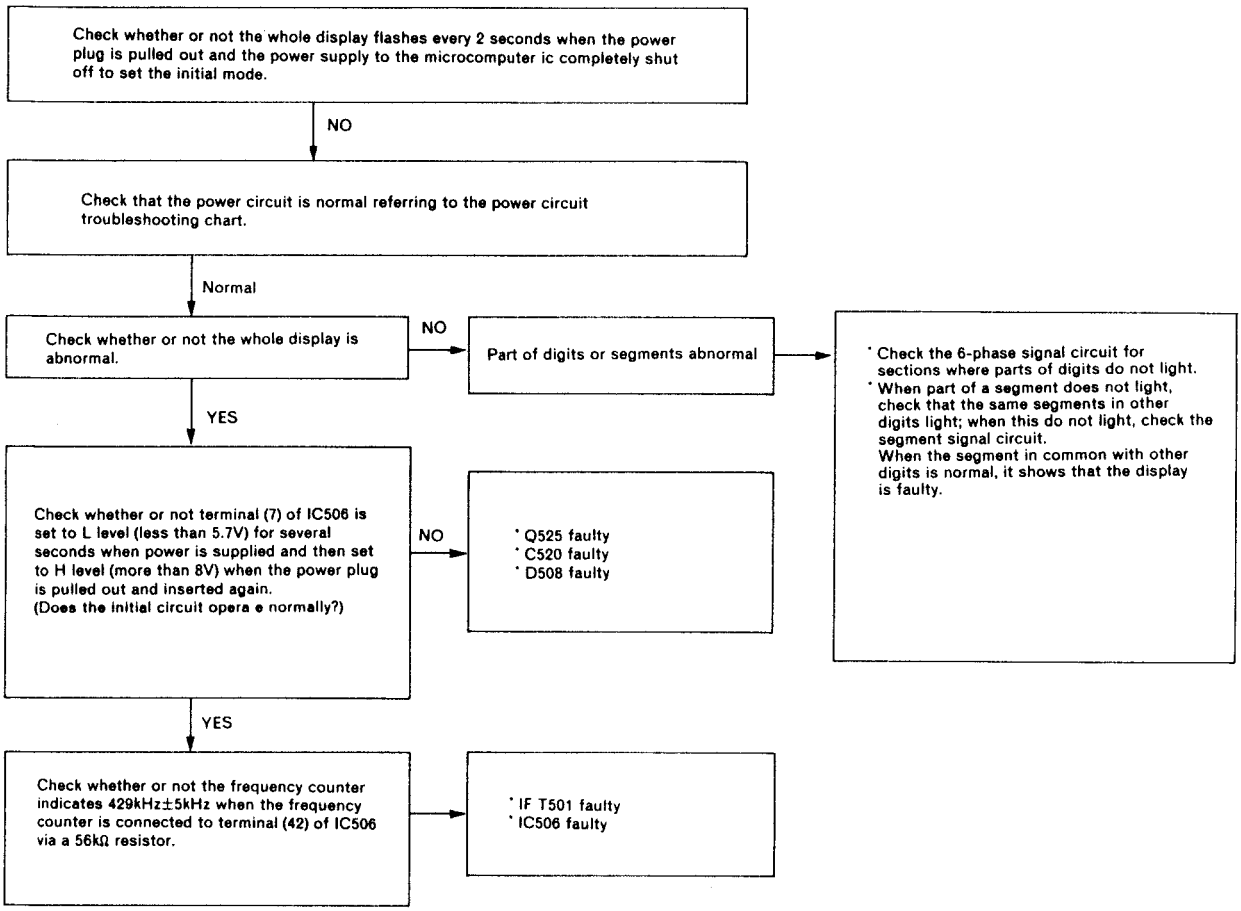
The radio and amplifier of this unit can be separated from the control circuit of the microcomputer by turning the STANDBY switch OFF, and so, troubleshooting for these sections apart from reception frequency indication can be done independently.The microcomputer determines the level of the mode selector switch, performs calculations and controls the indication on the display according to the program microcomputer, using the local oscillation frequency of each band and the clock reference pulse. Various types of microcomputer malfunctions may occur and the main ones are described here. It is recommended to act in accordance with the phenomenon.

Phenomenon 1. Display does not light

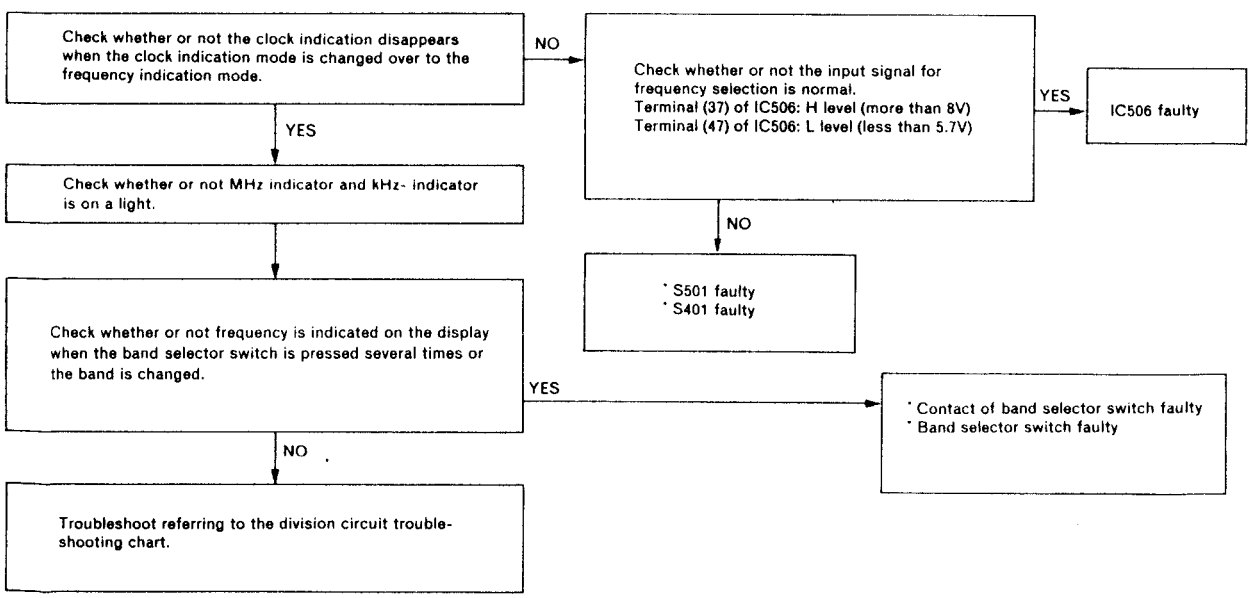
Switch on AC power supply and troubleshoot in the clock indication mode.



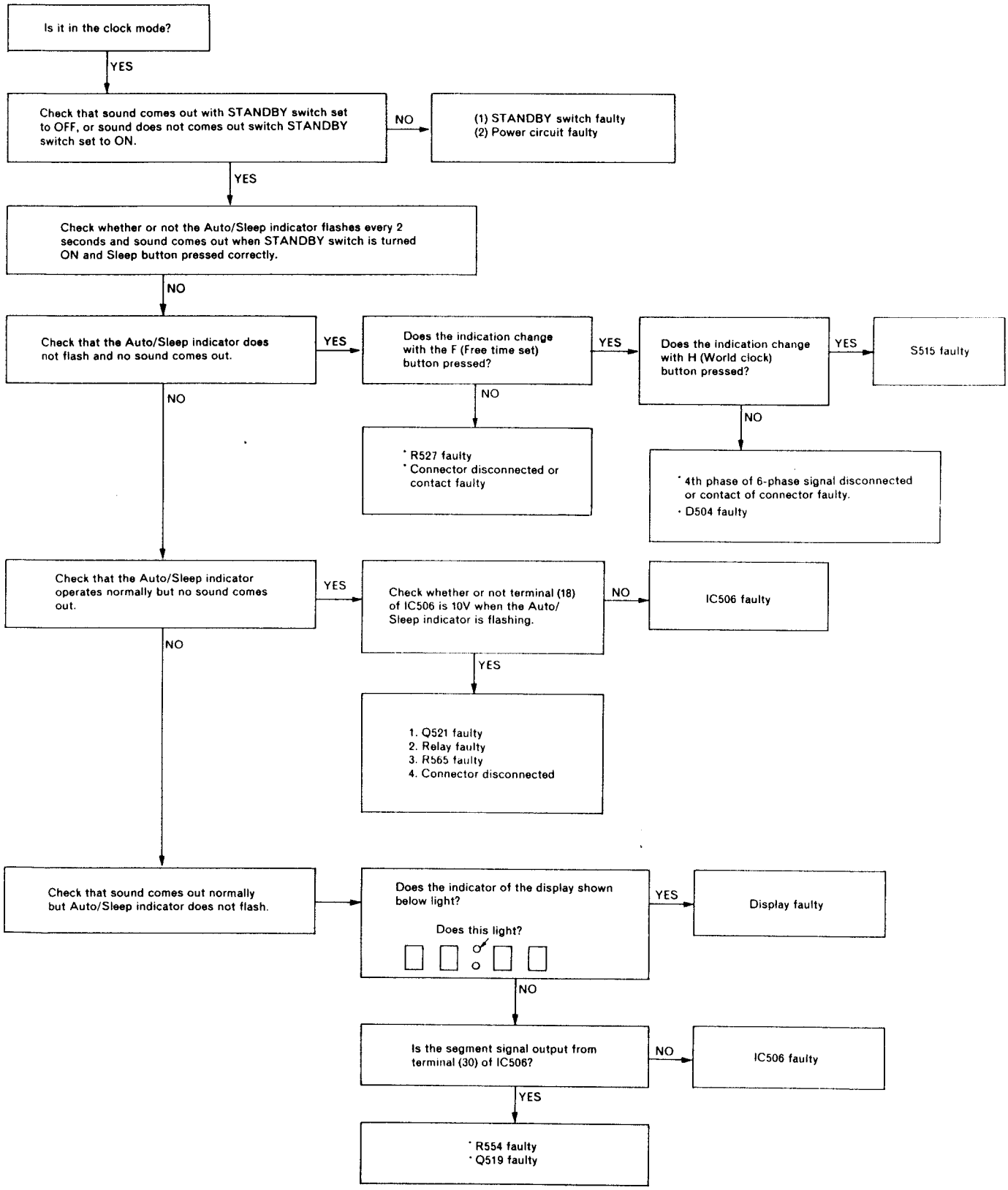
Phenomenon 2. Display is abnormal



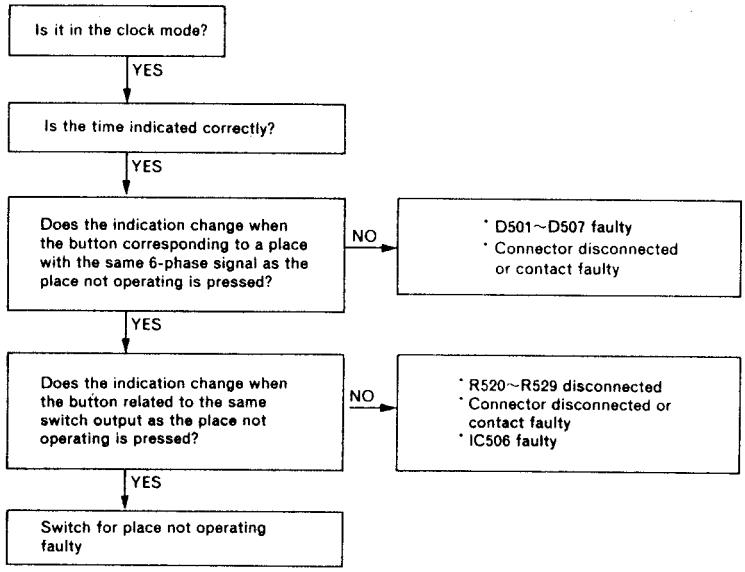
Phenomenon 3. Frequency is not displayed



Phenomenon 4. SLEEP function does not operate



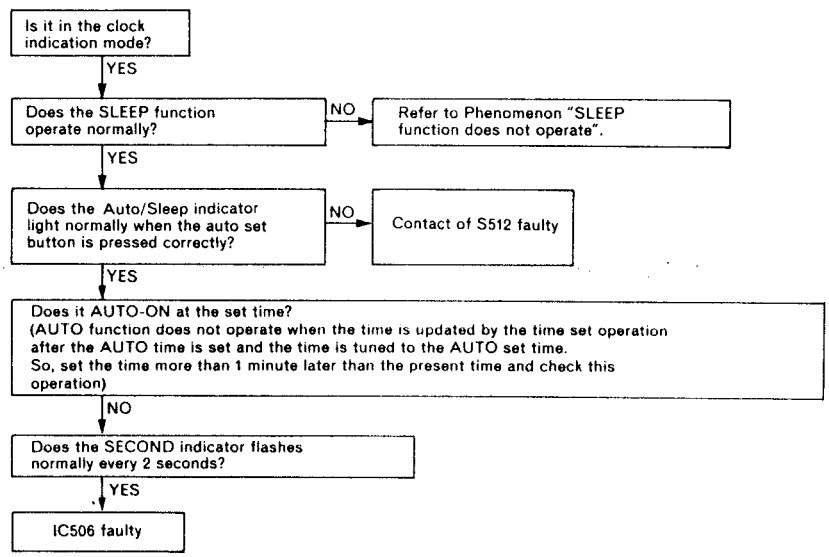
Phenomenon 5. Part of world clock does not operate



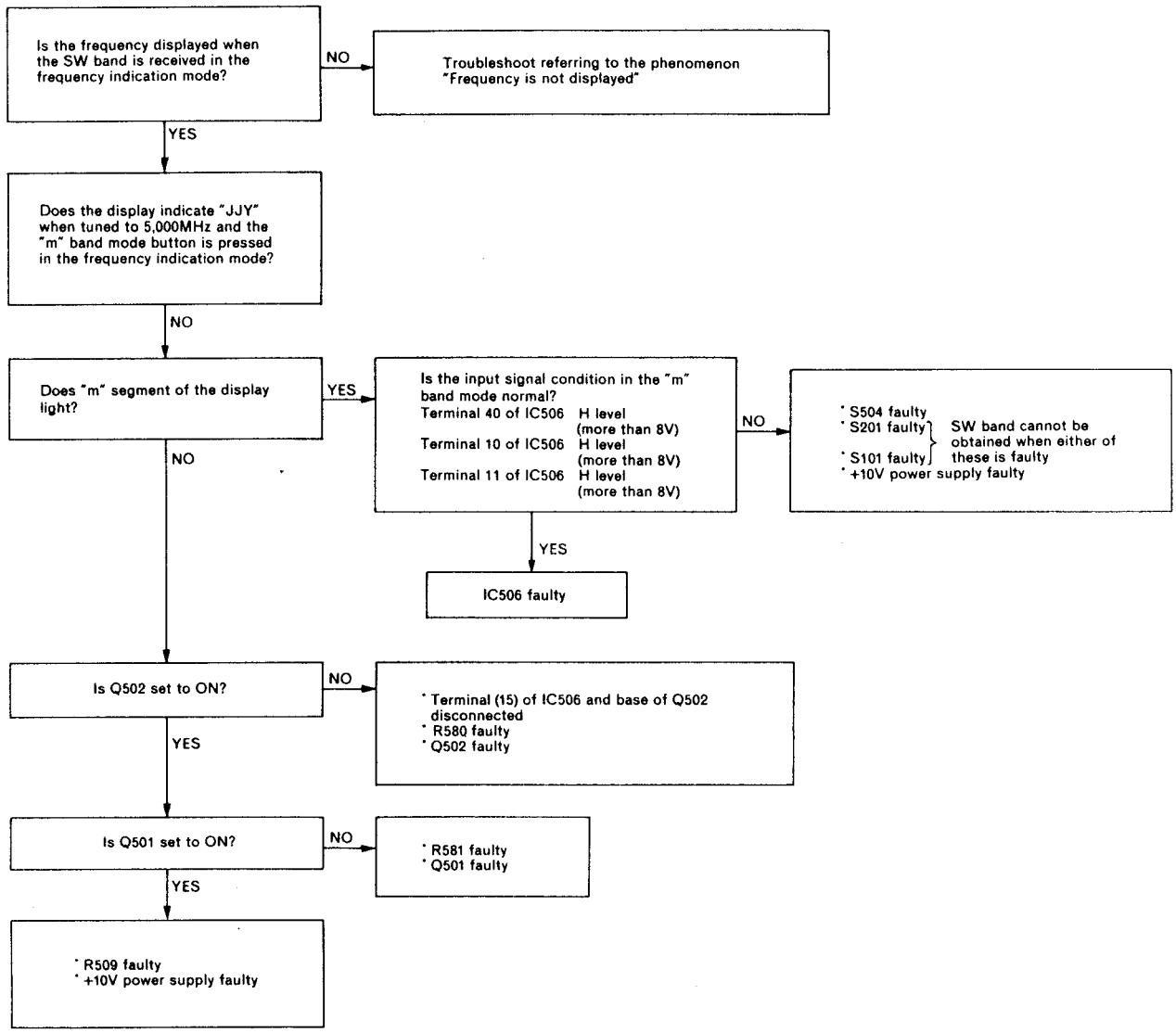
*1. Switch groups/related to each phase
1st phase B , F , P , L
2nd phase AUTO , C , A
3rd phase AUTO S/C , C , A
4th phase H , M , SLEEP S/C
5th phase MINUTE , HOUR , S
6th phase E , DIMMER

*2. Switch groups related to each matrix switch output
Terminal 33 of IC506 L , A , T , M , S, DIMMER
Terminal 34 of IC506 P , C , J , H , E
Terminbl 35 of IC506 F , AUTO , AUTO S/C , SLEEP S/C , HOUR
Terminal 36 of IC506 B , MINUTE

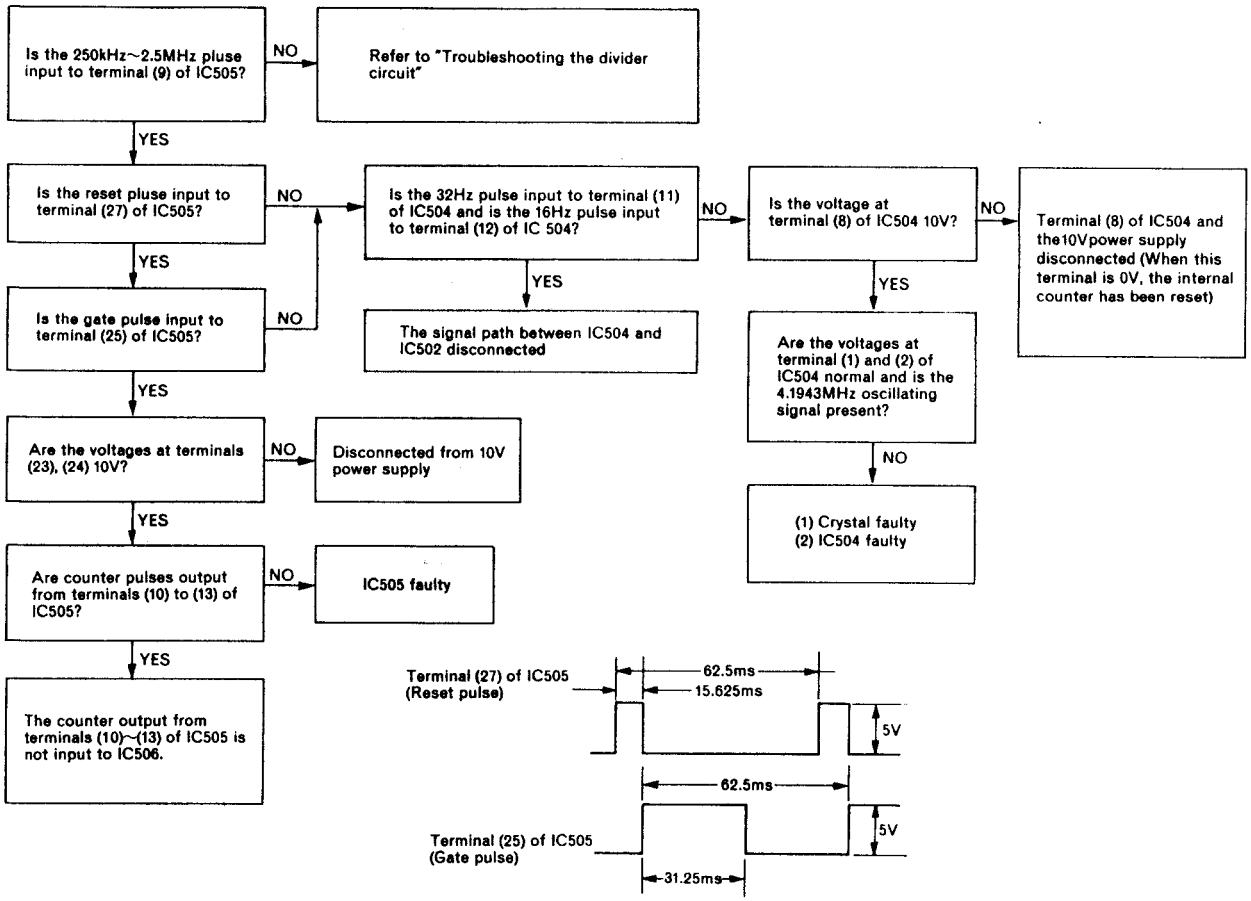
Phenomenon 6. AUTO function does not operate



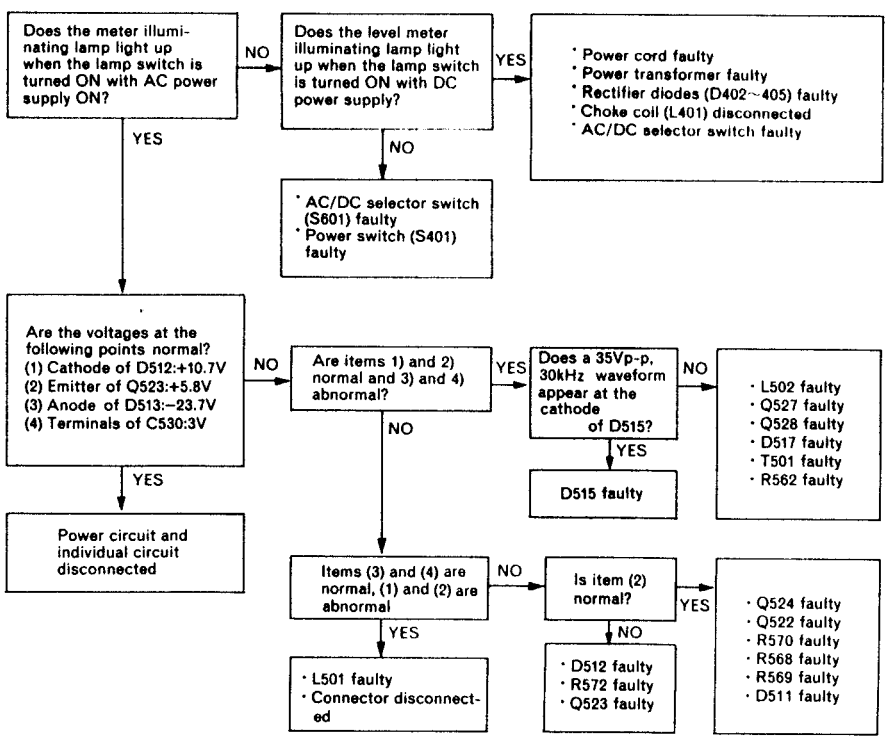
Phenomenon 7. "m" is not displayed



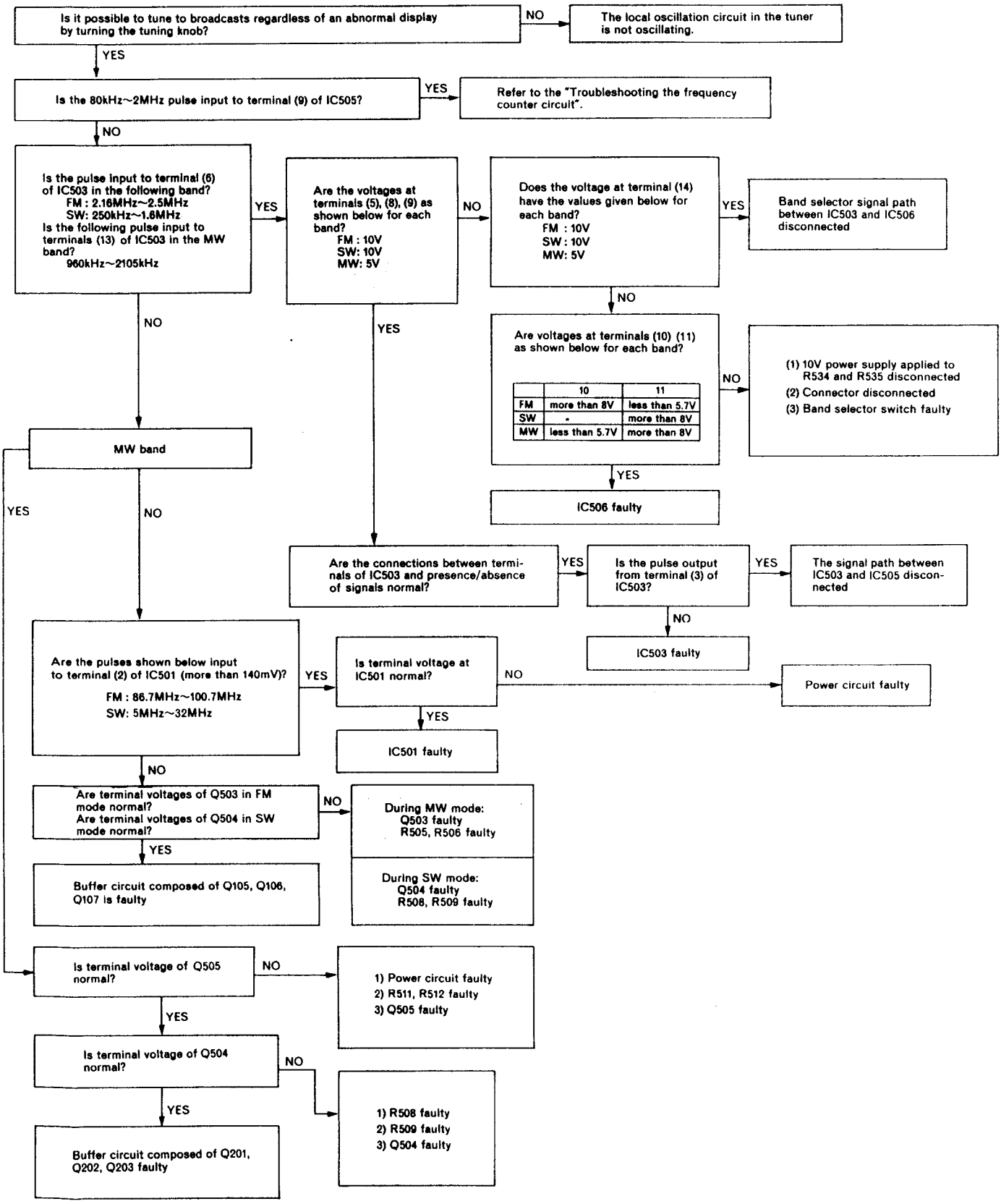
Troubleshooting the frequency counter circuit



Troubleshooting the power circuit



Troubleshooting the divider circuit



REPLACEMENT PARTS LIST

SYMBOL-NO	P-NO	DESCRIPTION
		CAPACITORS
CT101,102	5052321	PLASTIC FILM VARIABLE CAPACITOR
CV101,202	5052321	PLASTIC FILM VARIABLE CAPACITOR
		RESISTORS
RT101,203	5007281	SEMI VARIABLE 10KOHM
RV201	5000641	VARIABLE 50K OHM(A)
RV202	5000645	VARIABLE 50K OHM(B)
RV301	5000643	VARIABLE 50K OHM(C)
RV401	5000642	VARIABLE 50K OHM(B)
RV402	5000641	VARIABLE 50K OHM(A)
RV403	5000644	VARIABLE 50K OHM(D)
		SEMI-CONDUCTORS
D102-105	0575019	DIODE 1N60P
D106	5330133	DIODE SILICON 1S2076 100MHZ 250MW
D201	5331332	VARISTOR VD1222L
D202,203	5330133	DIODE SILICON 1S2076 100MHZ 250MW
D204	5331331	DIODE SD1/3
D205,206	0575001	DIODE GERMANIUM 1N34A 10M
D207,208	0575019	DIODE 1N60P
D401	5330392	ZENER DIODE SILICON HZ6B 1MHZ 400MW
D501-505	5331333	DIODE 1SS53
D507,509	5331333	DIODE 1SS53
D508,510	5330321	ZENER DIODE HZ-9A
D511	5330311	DIODE SILICON HZ7A 1.0M
D512,513	5330392	ZENER DIODE SILICON HZ6B 1MHZ 400MW
D514	0575005	DIODE GERMANIUM 1N60 80M
D515,516	5331333	DIODE 1SS53
D517	5331334	DIODE HZ24
D518	5331333	DIODE 1SS53
D601-608	5331336	DIODE ESAB03
IC001	5351641	IC UPC1018C
IC401	5351642	IC UPC575C
IC501	5351644	IC UPB551C
IC502,503	5351645	IC UPD4011D
IC504	5351646	IC MSM5564
IC505	5351647	IC TC5032P
IC506	5351643	IC UPD546-20
Q102-105	5322324	TRANSISTOR 2SA838B
Q106	5322338	TRANSISTOR 2SK49
Q107	5322327	TRANSISTOR 2SC1674K
Q108	5322329	TRANSISTOR 2SC829C
Q201	5322322	TRANSISTOR 2SK104Z
Q202	5322328	TRANSISTOR 2SC1675K
Q203	5322324	TRANSISTOR 2SA838B
Q205,206	5322325	TRANSISTOR 2SA838C
Q207	5322321	TRANSISTOR 2SK104F
Q208	5322331	TRANSISTOR 2SC945L
Q209,Q210	5322323	TRANSISTOR 2SA838A
Q212	5322324	TRANSISTOR 2SA838B
Q213	0573491	TRANSISTOR SILICON 2SC454 230M
Q214	5322326	TRANSISTOR 2SA564G
Q215	5322332	TRANSISTOR 2SC945AQ
Q216	5322329	TRANSISTOR 2SC829C
Q401,402	0573481	TRANSISTOR SILICON 2SC454 230M
Q403	5322333	TRANSISTOR 2SA683G
Q501,502	5322334	TRANSISTOR 2SA733P
Q506-520	5322334	TRANSISTOR 2SA733P
Q523	5322336	TRANSISTOR 2SA952
Q524	5322339	TRANSISTOR 2SC1566
Q525	5322334	TRANSISTOR 2SA733P
Q527	5322337	TRANSISTOR 2SA684
		TRANSFORMERS
IFT1	5130179	IF
PT	5212552	POWER
PT	5212553	POWER (HSE)
T101	5130173	FM IF
T102	5130174	FM IF
T201	5123746	SW OSCILLATOR
T202	5130171	SW DISCRIMINATOR
T203	5130172	SW IF
T204,206	5130175	AM IF
T205,207	5130176	AM IF
T208	5130177	AM IF
T209	5130178	BFO
T501	5260371	DC CONVERTER COIL
		COILS
L101	5123751	FM TRAP
L102	5123759	FM
L103	5123759	FM
L201	5123751	FM TRAP
L202	5113381	MW FERRITE CORE ANTENNA
L203	5123744	SW ANTENNA
L204	5123743	SW ANTENNA
L205	5123754	SW ANTENNA
L206	5123742	MW OSCILLATOR
L207	5123741	SW OSCILLATOR
L208	5123745	SW OSCILLATOR
L209	5123757	SW OSCILLATOR
L212,213	5123751	FM TRAP
L501	5123753	COIL
		MISCELLANEOUS
	5310331	DISPLAY INDICATOR TUBE 6LT-11
	5554741	TUNING METER
⚠	5639023	VOLTAGE CHANGE-OVER SWITCH

SYMBOL-NO	P-NO	DESCRIPTION
		MISCELLANEOUS
	5641321	RELAY
⚠	5652211	AC JACK
⚠	5652212	AC JACK (HSE)
	5673201	EARPHONE JACK
	5721201	FUSE 630MA
	5721202	FUSE 400MA
	5721203	FUSE 100MA
	5752491	ROD ANTENNA-SW
	5752492	ROD ANTENNA-FM
	5762471	PILOT LAMP
	5780521	CRYSTAL
BPF	5126743	FM FILTER
CF101-103	5160293	CERAMIC FILTER
CF201	5160091	CERAMIC FILTER
SP	5406471	SPEAKER-12CM
S201-204	5634261	SWITCH-BAND SELECTOR
S401,402	5604411	LEVER SWITCH
S403	5604412	LEVER SWITCH
S501,502	5634262	SWITCH
S503	5623701	SWITCH-AUTO DISPLAY
S504	5634262	SWITCH
S505-522	5633511	SWITCH
		FOR ACCESSARIES
	5660212	SIEMENS PLUG
⚠	5747214	POWER CORD
		MISCELLANEOUS
	6040972	REAR PANEL ASSEMBLY

SYMBOL-NO	P-NO	DESCRIPTION
	6040951	UPPER COVER
	6040961	BATTERY COVER
	6222601	CLEAR PANEL
	6051921	BUTTON (GRAY)-TIME SET
	6051922	BUTTON (WHITE)
	6051931	BUTTON-BAND SELECTOR/DISPLAY SELECTOR
	6754241	FRAME A-WORLD TIME
	6754251	FRAME B-TIME SET
	6754261	FRAME C-AUTO/SLEEP
	6754271	FRAME D-DISPLAY SELECTUR
	6754281	FRAME E-BAND SELECTOR
	6754231	FRAME-LEVER SWITCH
	6660621	SPEAKER NET
	6631752	PANEL OVERLAY
	6671572	FRONT PANEL
	6669541	TUNING KNOB
	6631741	TUNING SUB RING
	6669551	KNOB-VOLUME,BASS,TREBLE,RF,PITCH
	6690381	SW CAL KNOB
	6334011	HANDLE
	6690391	SCREW-BATTERY COVER
	7089861	DIAL ASSEMBLY
	6256094	LEVER KNOB
	6256093	LEVER KNOB(BLACK)
	6796171	RUBBER LEG

HITACHI

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Printed in Japan (K)